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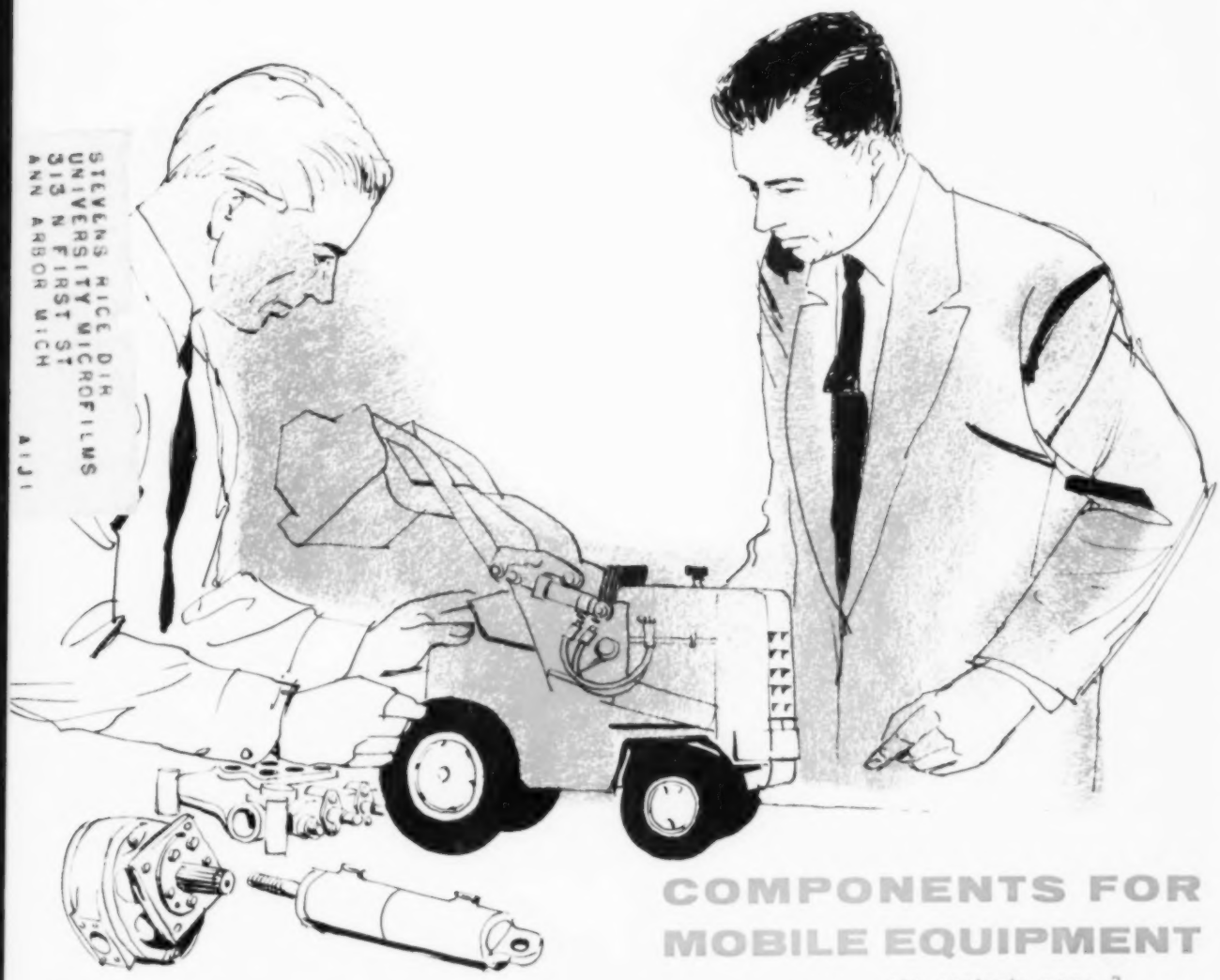

COMPONENTS FOR MOBILE EQUIPMENT

see contents page 3

THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

For information about the
JANUARY 1959 DESIGNERS' GUIDE ISSUE
See page 126

shuts off both sides of line... prevents loss of liquid, gas, or pressure.
Available in brass or steel with female pipe thread connections from ⅛" to 1"

FOR PRESSURE OR VACUUM SERVICE

HANSEN

QUICK-CONNECTIVE TWO-WAY SHUT-OFF COUPLINGS

Both ends of line are positively sealed when you disconnect a Hansen Series HK Two-Way Shut-Off Coupling. To connect, just pull back sleeve and push Plug into Socket. To disconnect, merely pull back sleeve. No tools required. Identical valves in Socket and Plug permit free flow of gas or liquid when Coupling is connected—practically eliminate spilling of liquid or escape of gas when disconnected.

REPRESENTATIVES IN PRINCIPAL CITIES

WRITE FOR THE HANSEN CATALOG

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for Steam, Oxygen, Acetylene, etc.

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

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CONTROL FLUID FLOW

with Micrometer Accuracy

HANNA *Flo-Set* VALVES

For AIR, OIL and WATER operation to 250 p.s.i.
SIZES ¼" • ⅜" • ½" • ¾"
TEMPERATURES to 250°F

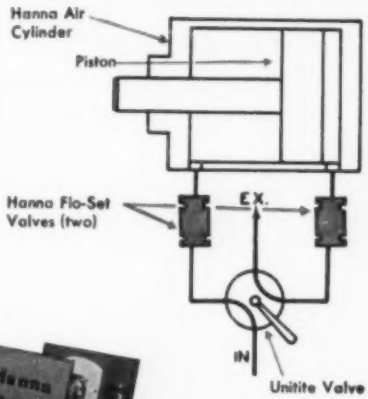
Hanna Flo-Set Valves are used to control cylinder piston speeds and operating speeds of many types of fluid actuated mechanisms. They are able to handle air, oil, water and many gases. When used with cylinders, these valves permit independent adjustments of forward and return piston speeds. The diagram at the right shows a typical circuit. Flo-Set Valves make the operation of air cylinders smoother and make cushioned cylinders more effective by building up essential back pressure.

Fluids pass unobstructed in the direction of the arrow on Hanna Flo-Set Valves. In the opposite direction, flow can be controlled from zero to full pipe capacity. One valve can be set to an infinite number of controlled flow positions. Once set, the position can be held by means of a locking collar. Established flow positions can be reset by using the micrometer graduations which accurately measure flow as a percent of full pipe capacity.

One revolution of the aluminum valve body will change the flow rate from zero to full capacity. No tools are necessary! In addition to the standard ¼", ⅜", ½" and ¾" sizes, there is a ¼" Jr. model, without micrometer graduations or locking collar, for light piping and tubing.

Typical Cylinder Circuit Using Hanna Flo-Set Speed Control Valves

Hanna engineers will gladly recommend circuits to help you with your applications.



Consult your classified telephone directory or Thomas' Register for your nearest Hanna representative. Write for Hanna Valve Catalog 254 and Flo-Set Valve Bulletin 253A.

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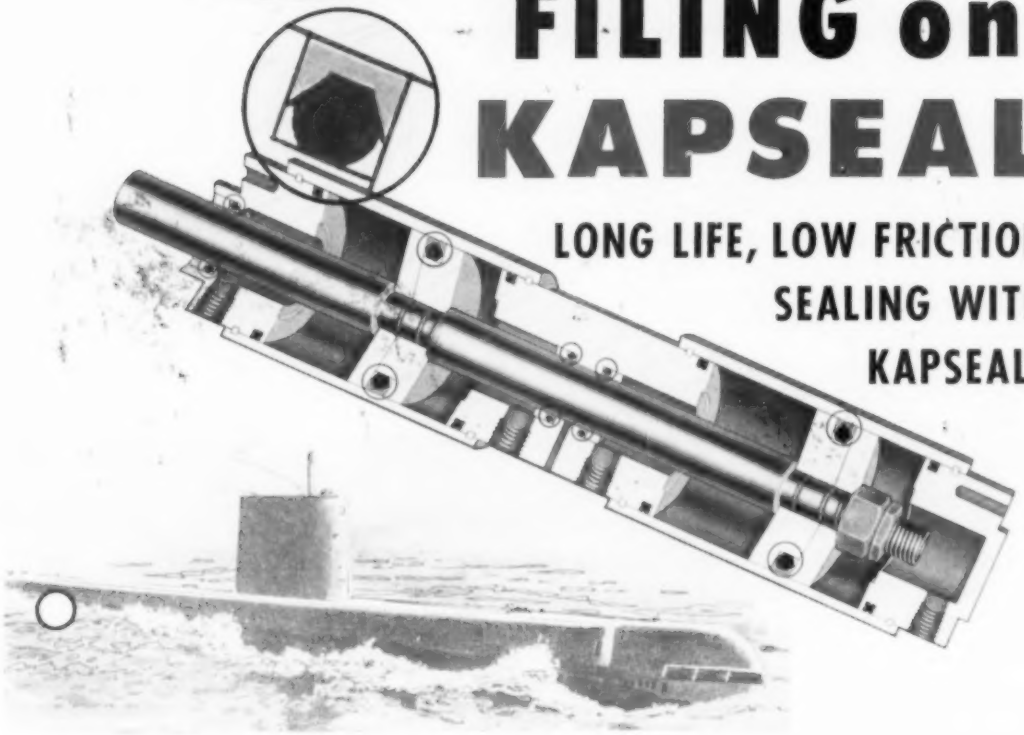
FACTS for FILING on KAPSEAL®

LONG LIFE, LOW FRICTION SEALING WITH KAPSEAL!



The KAPSEAL® is a Teflon® "boot" which is used with a standard O-ring to provide a good seal with superior frictional and wear characteristics.

LONG LIFE The KAPSEAL has been tested on dynamic installations in both the laboratory and the field with outstanding results. Tests have run over 4,000,000 cycles before they were discontinued, while a hydraulic control valve has logged over 2,000,000 cycles. On a rod-seal installation it is performing satisfactorily at 1500 PSI.

LOW FRICTION The KAPSEAL is made out of Teflon because of the extremely low coefficient of friction this material has. It provides a sealing member with low breakout friction. Teflon is superior to rubber in this respect because its breakout and running friction are the same while rubber's breakout friction is about 50 times greater than its running friction. Thus the Kapseal-O-ring combination provide good sealing characteristics, and the ability to perform satisfactorily after prolonged periods of inactivity.

COMBINES WITH A STANDARD O-RING

The KAPSEAL comes in two styles, KIN and KEX. KIN is used when the ID of the seal is the sealing surface, while KEX is used when the OD is the sealing surface. The KAPSEAL combines with a standard O-ring and the combination can be installed in any gland that was designed for the O-ring only. The combination can also be used to replace stacks of V-rings giving a greatly simplified design. A "buttoned-up" design is possible because the long-life, low-friction characteristics of the KAPSEAL reduce seal replacement requirements to the extent that the mechanism can be sealed shut.

WHERE LIFE OR FRICTION IS A PROBLEM, THE KAPSEAL IS THE ANSWER

KAPSEAL is a trademark of Minnesota Rubber Co.
Teflon is a trademark of the DuPont Company

FOR MORE INFORMATION ON THE KAPSEAL . . .

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Hydraulics & Pneumatics

VOLUME 11/NUMBER 12

DECEMBER 1958

THE MAGAZINE OF FLUID POWER

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100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

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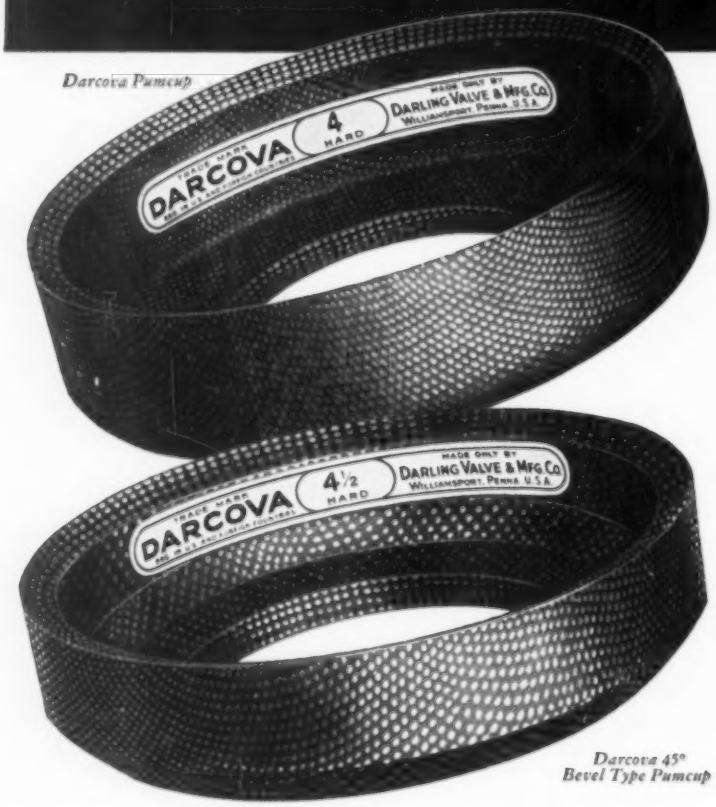

Darcova 45° Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

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THE ORIGINAL COMPOSITION CUP

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PUMCUPS

CIRCLE 26 ON TIME-SAVER CARD

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THE MAGAZINE OF FLUID POWER

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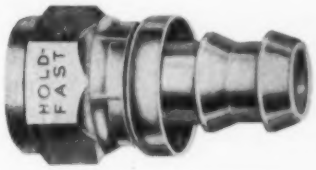
ANCHOR INTRODUCES NEW LINE OF "HOLD-FAST" REUSABLE COUPLING ASSEMBLIES

Designed for low pressure industrial and marine applications.



A new line of low pressure "Hold-Fast" Couplings has just been announced by the Anchor Coupling Co. Inc., designed for general, low pressure, hydraulic and fluid transfer service in the industrial, automotive and agricultural fields.

Because attachment or removal from the hose is quickly and easily accomplished, without the use of tools, the new couplings are especially well adapted for fast, emergency field repair.

A wide range of styles and sizes is available, including couplings suitable for virtually every general, low pressure application. As they are reusable, their adoption permits substantial economies and minimum replacement inventory requirements.

ASSEMBLY IS SIMPLE AND QUICK

To assemble these new Anchor Reusable "Hold-Fast" Couplings, the hose is simply forced over the stem until it seats against the bottom of the protective cap.

NEW LOW PRESSURE HOSE AVAILABLE

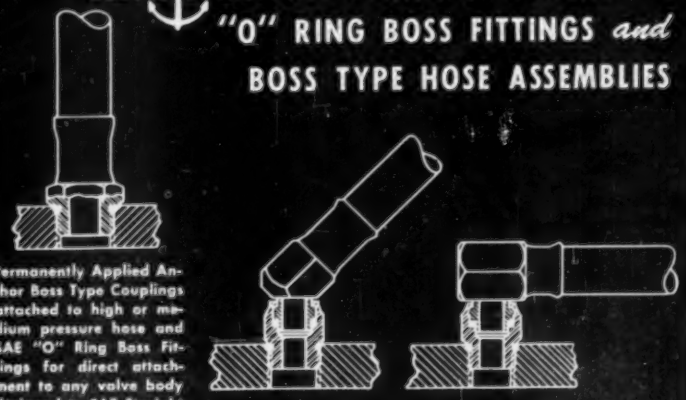
To complement these new low pressure couplings, Anchor is introducing two new styles of low pressure, 1-cotton braid hose. Style No. PR has a synthetic rubber inner tube and cover; Style No. PQ is of similar construction except that it has an abrasion resistant braided cotton cover that is impregnated with an oil and mildew resistant synthetic rubber compound.

Complete specifications on the new "Hold-Fast" Couplings and low pressure hose may be obtained from a supplement to Catalog 302, available on request from Anchor Coupling Co., Inc., 324 No. Fourth St., Libertyville, Ill.

For Simpler, More Compact Hook-Ups—

Make them with

ANCHOR® SAE STRAIGHT THREAD "O" RING BOSS FITTINGS *and* BOSS TYPE HOSE ASSEMBLIES

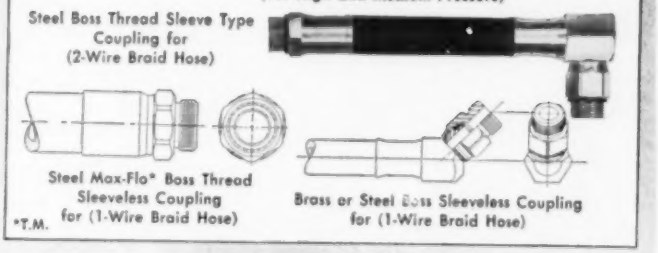


Permanently Applied Anchor Boss Type Couplings attached to high or medium pressure hose and SAE "O" Ring Boss Fittings for direct attachment to any valve body designed to SAE Straight Thread "O" Ring Boss specifications.

A comprehensive line of SAE Straight Thread "O" Ring Boss Fittings for connections.

PLUS ANCHOR BOSS TYPE HOSE ASSEMBLIES

(For High and Medium Pressure)


Steel Boss Thread Sleeve Type Coupling for (2-Wire Braid Hose)
Steel Max-Flo* Boss Thread Sleeveless Coupling for (1-Wire Braid Hose)
*T.M.
Brass or Steel Boss Sleeveless Coupling for (1-Wire Braid Hose)

It's amazing what clean, compact hydraulic hook-ups you can make with these Anchor products! You'll appreciate them most when making connections in closely confined areas.

They're neat, orderly and compact always—ready for connection to any valve port designed to SAE Straight Thread "O" Ring Boss specifications. Excessive tightening is not required with the "O" Ring Seal, eliminating leakage danger from cracked and distorted valve seats and threads, and assuring a leak-proof connection.

For complete details write for Anchor Catalogs No. 101 and No. 204.

Andy Anchor Says: It's the years of experience that makes every Anchor product a leader of its type.

ANCHOR COUPLING CO. INC.

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CIRCLE 13 ON TIME-SAVER CARD

. . . Fluid Power news

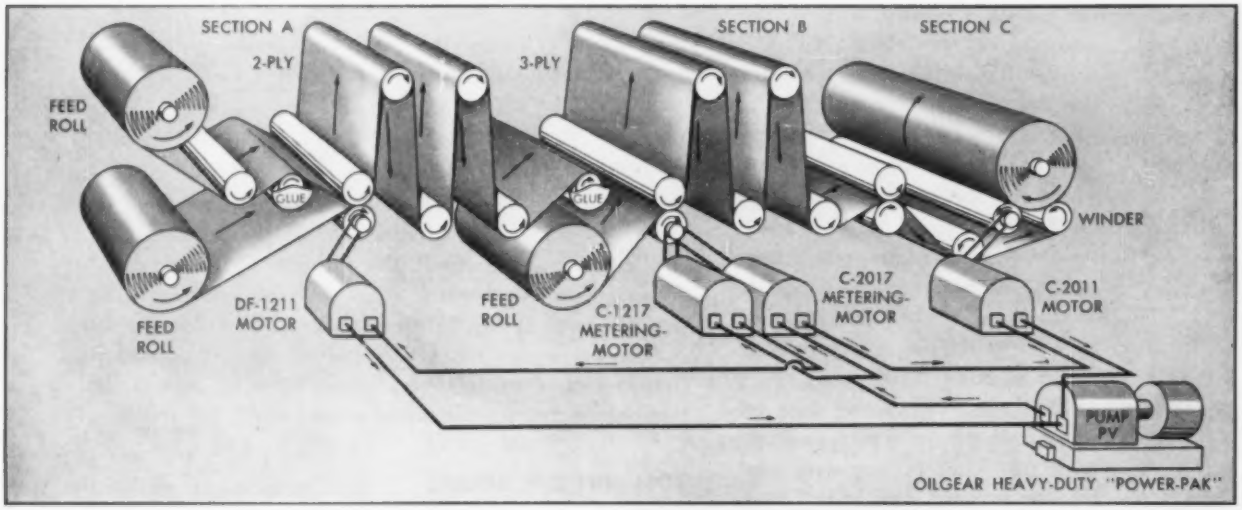
REPORT NO. 12,101
FAST-ACTING MULTI-STAGE DRIVE

From Oilgear Application-Engineering Files

HOW OILGEAR "*ANY-SPEED*" DRIVES SIMPLIFIED MODERNIZATION OF A LAMINATOR

CUSTOMER: *A Large Midwestern Paper Manufacturer*

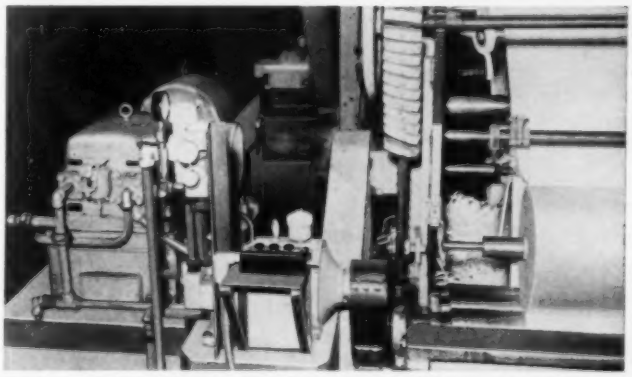
DATA: This company initiated an extensive equipment modernization program to enable expansion in competitive fields, and increase production efficiency. Part of this program consisted of adding a new section to an Oilgear-powered laminator and winder. *Requirements:* 1: Maintain proportional synchronization and power coordination between existing section and winder with new section. 2: Fast-acting controls for individual, precision, sectional speed adjustments. 3: Start, stop, change speeds rapidly, and run at *any* selected speed to maximum without tearing paper web. 4: Accurate, adjustable, automatic winder tension control. 5: Complete conversion in minimum of machine "downtime." 6: Selected drive must be thrifty on floor space and electrical power.



OILGEAR HEAVY-DUTY "POWER-PAK"

SOLUTION: Shown above schematically with new section A to left. Oilgear Heavy-Duty, "*Any-Speed*" drives were selected for this application primarily because of space savings, ease and speed of conversion, and long experience with Oilgear's *low-cost-per-year* operational record in their plants. Unusual application feature is the use of a single, Oilgear Size 35 "Power-Pak" as the Fluid Power source for all three exactly coordinated sections of this multi-stage machine. *Performance has proved superior to requested specifications — with no reported maintenance after more than two years of continuous, high-speed service.*

OPERATION: Oilgear type "DE" Variable Displacement Pump (PV) — accurately, remote pushbutton station controlled from zero to maximum output — drives two Oilgear type "C" fixed stroke, constant torque, radial piston motors (C-1217, C-2017). Acting as tandem motors, they power section B. They also act as meters for motors (DF-1211, C-2011) connected in series with them. Oilgear type "DF" variable stroke, constant hp, radial piston motor (DF-1211) powers new section A in series with section B motor (C-1217). Oilgear type "C" motor (C-2011) powers section C in series with section B motor (C-2017). Speed changes initiated from control station pushbuttons to Pump (PV), are imparted to section B, and proportionally to sections A and C. Proportional speed relationship between sections A and B is easily altered by stroke adjustment of motor (DF-1211). Speed relationship between sections B and C is automatically altered as roll diameter increases by an automatic winder tension valve. Maximum torque in section A is independently adjustable. Solenoid-operated brake valves insure rapid, cushioned stops. Rapid, cushioned starts are an inherent feature of Oilgear "*Any-Speed*" drives. This completely sealed, compact, fully pressure lubricated, "*Controlled-Motion System* delivers full rated torque at "*Any-Speed*" . . . automatically conserves electric power . . . quiet, vibration and trouble-free.


View from winder end of laminating machine after a "rush" conversion, completed and running without trouble ahead of schedule. Oilgear Heavy-Duty, Size 35 "Power-Pak" can be seen in left foreground. One pushbutton control station and winder tension valve are to left and in front of series driven, Oilgear type "C" motor which powers the winder section. Oilgear "C-2017" motor, one of the tandem drive metering-motors on the center section, can be seen in center background.

Because of Oilgear's long reputation for cooperative teamwork in solving drive problems with dependable, trouble-free Fluid Power Systems for virtually any application — Oilgear has become a name that all industry trusts . . . and uses.

For similar practical solutions to YOUR linear or rotary Controlled-Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

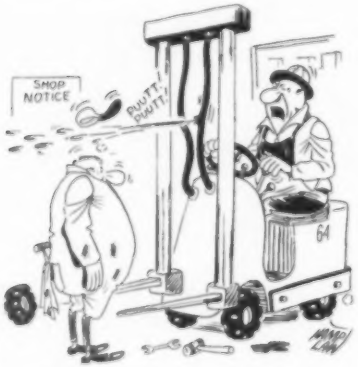
THE OILGEAR COMPANY
Application-Engineered Controlled Motion Systems
1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

FLUID POWER LINES

about hydraulics & pneumatics

PREVIEWS OF COMING COMPONENTS . . . If you want to know what's coming in new hydraulic and pneumatic components for mobile equipment—lift trucks, mining machines, earth-moving equipment—ask the designers who use them. Find out where they're going in horsepowers and pressures; ask them what they'll need for tomorrow's machines. Then take these remarks to the component manufacturers and see what they have to say about meeting these needs.

That's just what we've done in preparing the special report on page 63. After talking with mobile equipment designers and component manufacturers we got a very sharp picture of what's needed and what's available. Check these needs against your own, and see what's being done about them.



All I did was screw down the relief!

UP AND UP . . . Nowhere does higher pressure seem more attractive than in mobile equipment. Constantlty urging machines to put out more power in less space has produced a bull market in pressures. Taking fullest advantage of components rated for the highest pressures, Bucyrus-Erie has designed their Hydrohoe for 6000 psi. To learn how they did it see page 68.

HYDROSTATIC DRIVE . . . "Hydrostatic transmissions for propelling vehicles will be common five years from now. Their cost today compared to mechanical drives is 1.5:1, and in some applications, the ratio is even lower." That remark was made recently at the SAE National Farm, Construction, and Industrial Machinery Meeting. Another development in this trend is shown in *Four Fluid Motors Give Series, Parallel Drive* which explains how a drive was engineered for an experimental Army lift truck.

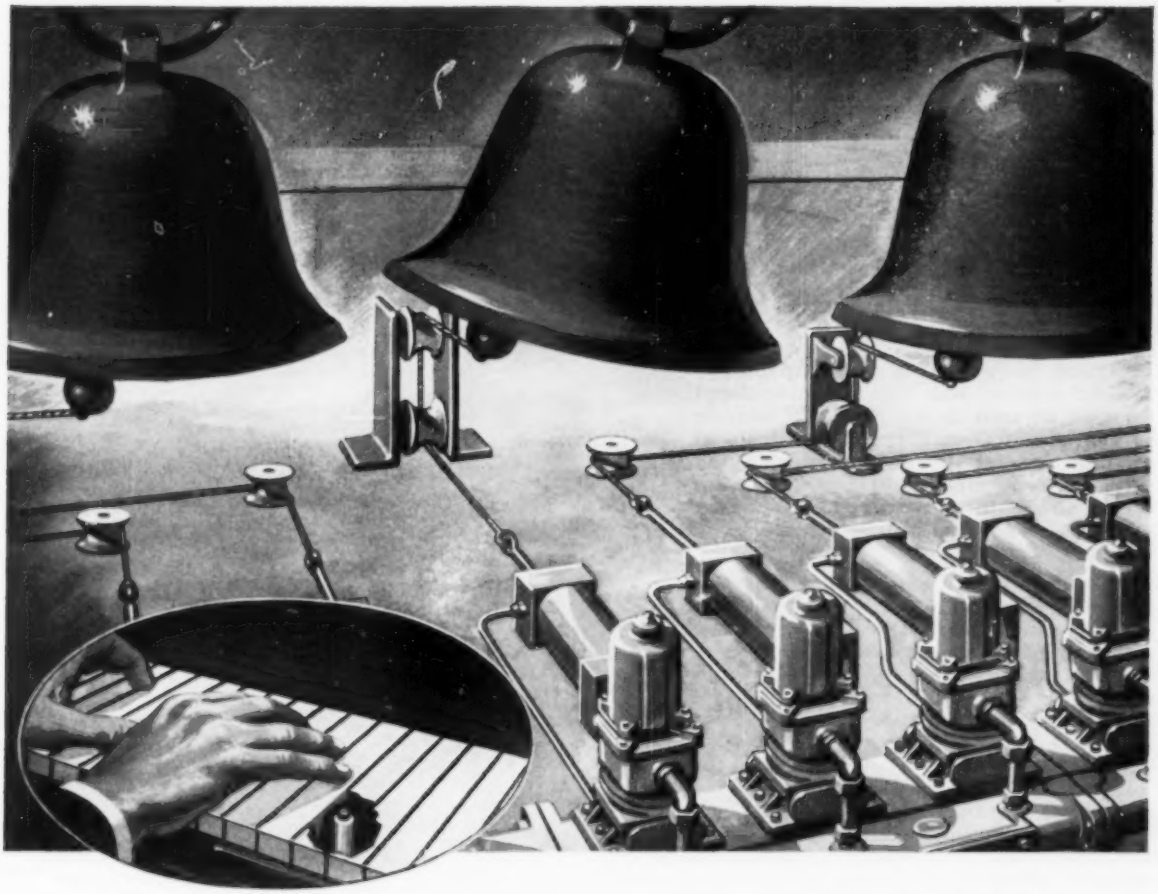
ROLL OUT THE BARREL . . . Just because you want a hydraulically operated conveyor in a beer truck is no reason to run hoses all over it. Why mount a pump way up on the engine, when you can drive it with an air motor powered from the brake system? Read about the system for this time-and-back-saver on page 67.

NOW FOR THE SQUARE WHEELS . . . Though you may not suspect it after traveling 400 miles in an upper berth, the railroads have big programs to enhance your riding comfort. Track maintenance is a field where machines are fast replacing labor gangs. The big design feature of the track aligner described in *Adjustable Relief Valve Regulates Pull* is manual pressure control.

HOT CRYSTAL BALL . . . What's the big factor in designing future aircraft hydraulic systems? Higher temperature. It's the reason for intensive research on fluids, packings, and materials. This month's aircraft article outlines how far developments have come, and suggests some new approaches.

lubricated, "Controlled-Motion System" delivers full rated torque at "Any-Speed" . . . automatically conserves electric power . . . quiet, vibration and trouble-free.

Application-Engineered Controlled Motion Systems
1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN



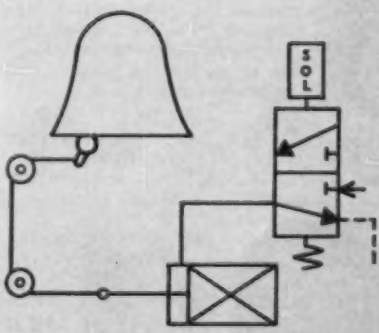
What? Air Power Rings the Bells!

Air powered clappers for the bell tower may be strictly fiction, but . . .

Can you imagine a keyboard that's a set of electrical switches. They operate a set of solenoid valves which in turn advance and retract cylinders. The cylinders, of course, pull the clapper cords. Shows that anything can happen when an air-minded engineer gets in the spirit of the season. But while this is just a flight of the imagination that you aren't likely to see installed in a carillon soon, you might very well want to take advantage of the underlying idea in some of your *plant operations*. Here is the idea:

Just one operator can control hundreds of operations by using solenoid valves.

And these solenoid valves, you'll notice, are manifolded. The manifolding saves piping, space, etc., just as has been possible for years with Ross valves that are operated manually, by air, cams, etc. Incidentally, you won't find this manifold in our catalog . . . it is one of the many refinements and variations of the standard Ross line that make it so flexible. To keep fully aware of the developments continually being made to increase the flexibility of the Ross line, keep in close touch with your local Ross Valve Engineer.



SEQUENCE OF OPERATION

Every time solenoid is energized, bell clapper is pulled against bell.

ROSS OPERATING VALVE CO. 105 East Golden Gate • Detroit 3, Michigan

CIRCLE 85 ON TIME-SAVER CARD

ACCO
Helicoid Gage
U.S.A.

NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

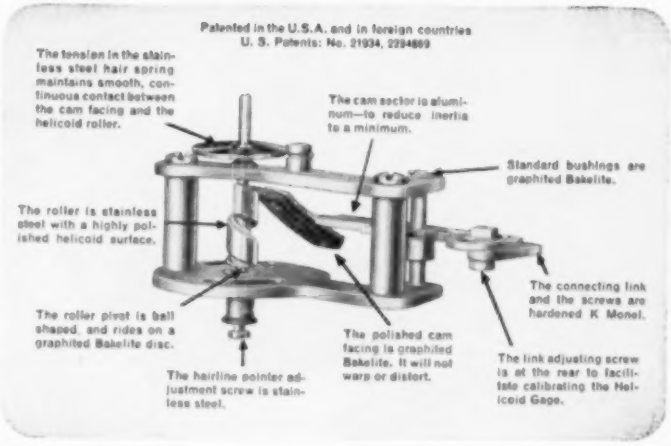
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294869
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

HELICOID GAGE CARTRIDGE SNUBBER

(Patent pending)

Enlarged cutaway view

This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank

EASIEST ADJUSTMENT AND CALIBRATION

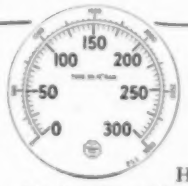
Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.



DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

ACCO
TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

CIRCLE 46 ON TIME-SAVER CARD

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!

You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. IMMEDIATE SHIPMENT in a wide range of styles and capacities, with 64,000 combinations. Write for Bulletin SM 155-3 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
HYDRAULIC AIR AND HYDRAULIC CYLINDERS, CUTTERS, CLINCHERS

METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

ONE PIECE PISTON . . . Standard at No Extra Cost!

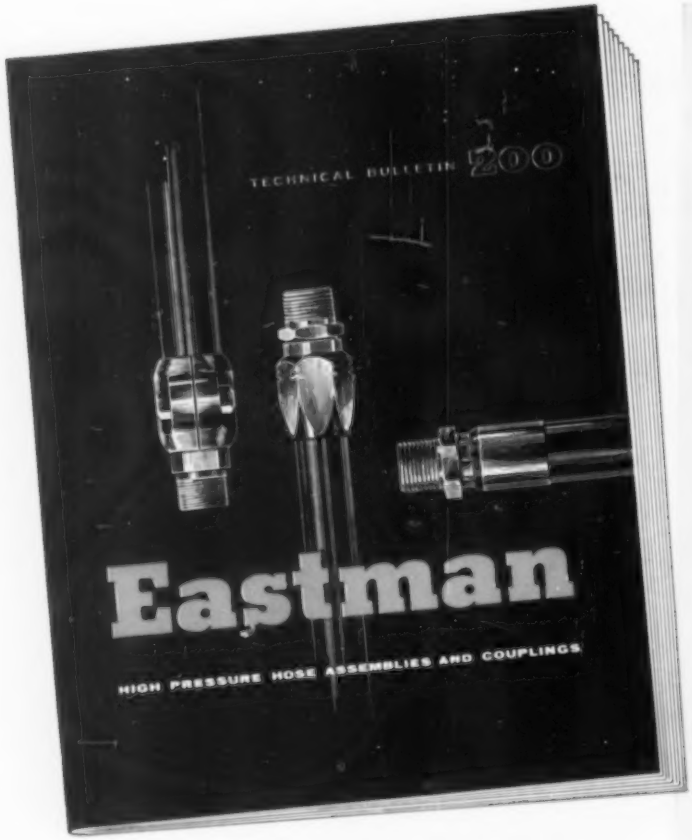
NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

CIRCLE 95 ON *TIME-SAVER CARD*



CONVENIENTLY ARRANGED TO HELP YOU MEET THE INCREASING DEMAND FOR HIGHER PRESSURES

Here's an entirely new service concept in catalog arrangement. It is designed to assist Engineers and Purchasing Agents in specifying Multi-Braid Hydraulic Hose and Tube Assemblies to meet the demand for increasing pressure requirements. With pressure as a primary consideration—the right assembly can be selected for the specific equipment on which it is to be used.

Nine major sections are devoted to assemblies suited to all types of high pressure hydraulic applications—complete with tables and specifications, including easy to read dimensional cross section drawings.

Include this new catalog in your files to make it easier to specify the proper assemblies.

Write for Your Copy Today!

Eastman *first in the field* **MANUFACTURING COMPANY**
Dept. AH-12, MANITOWOC, WISCONSIN

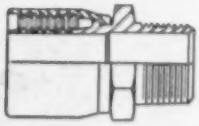
SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

CIRCLE 31 ON TIME-SAVER CARD

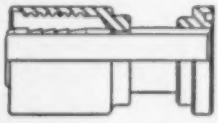
AN INSIDE LOOK AT A *NEW BOOK*

Eastman's new Technical Bulletin offers a new standard in simplified arrangement—for your convenience in specifying—according to your pressure requirements.

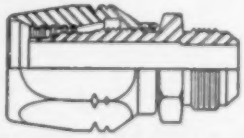
Swivel "O" Ring Male Couplings are available in 45° and 90° angles. Specifications on Page 13.



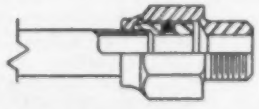
Permanently Attached Couplings for 2-wire braid hose. Specifications and Details on Page 10.



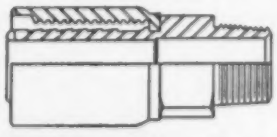
Permanently Attached Flange Head Couplings and Inserts from 0° to 90°. See complete list on Page 21.



2-Piece Reusable Couplings for all high pressure hose. Used for pressures up to 5000 lbs. See Page 25.



Swivel Male Tube Nut "O" Ring Assembly used on formed tubing—described on Page 30.



Permanently Attached Couplings for Extreme High Pressures up to 7000 lbs. working pressure, Page 12.

LETTERS
to the editor

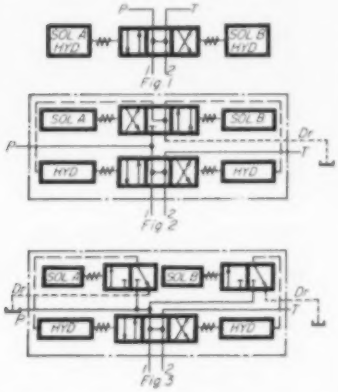
Address your letters to: Editor, APPLIED HYDRAULICS & PNEUMATICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Simplified Symbol

TO THE EDITOR:

On page 75 of the February 1957 APPLIED HYDRAULICS Magazine the symbol in Fig. 1 is used in the hydraulic schematic.

This simplified symbol would represent a 3-position, 4-connection, spring-centered, open-center, solenoid-controlled, pilot-operated directional valve. The complete



symbol for this valve, as a subplate mounted type, is shown in Fig. 2.

Fig. 3 illustrates the complete symbol of an equivalent valve but with connections in the body.

The latter valve uses an additional spool; however, in neutral the flow is identical except that two drains are used instead of one. It is our opinion that the simplified symbol applies to either type of valve and we would like to know which type was used in this circuit.

CHARLES G. TERRY
Engineering Dept.
Samuel M. Langston Co.
Camden, N. J.

We have used a simplified symbol for a solenoid-controlled, pilot-operated directional valve. We do this so that our drawings will not be too complex and will fit into

Continued on page 16

Another example of SYSTEMS CAPABILITY *at Sanders Associates, Inc.*

SV 324
SERVO VALVE

ELECTRO-HYDRAULIC CONTROL COMES DOWN TO EARTH!

Feedback principles that control missiles and aircraft in flight now produce uniform road grades regardless of ground variations.

This electro-hydraulic feedback system for controlling heavy earth-moving machinery, developed by Sanders Associates, Inc., is now in the field test stage.

In this application, the blade of a road grading machine is automatically controlled at a pre-set angle regardless of the contour or roughness of the ground over which the grader travels. Leveling accuracy of the system is ⅛ inch in ten feet or 1 milli-radian. The result is faster, simpler grader operation, improved smoothness of road beds, reduced operating costs.

This is another example of how the integrated "systems engineering" approach at Sanders can provide unusual and effective solutions to your control problems in industrial, marine, missile, aircraft, or atomic fields.

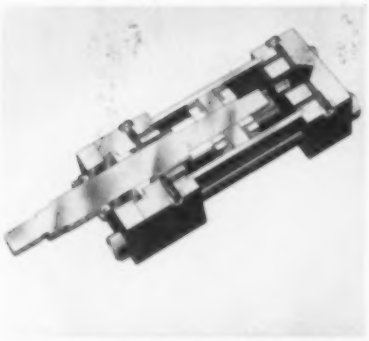
Sanders manufactures and supplies all major components of electro-hydraulic control systems; a complete line of servo valves for positioning; rate gyros and accelerometers for sensing; electronic components for amplifying and decision-making. This practical experience in hydraulics, electro-mechanics and electronics can expedite development of new automatic control systems for machine tools, structural testing, materials handling and construction equipment as well as military applications.

SANDERS ASSOCIATES, INC.

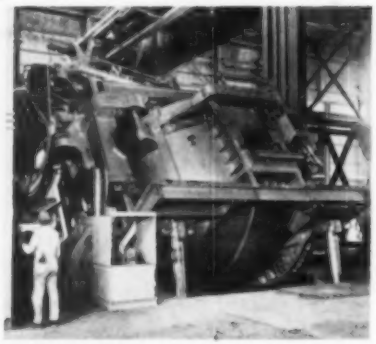
NASHUA, NEW HAMPSHIRE • Dayton, Ohio • Inglewood, California • Washington, D. C.

CIRCLE 86 ON TIME-SAVER CARD

Look who's found hydraulic equipment wins more jobs with firesafe PYDRAUL

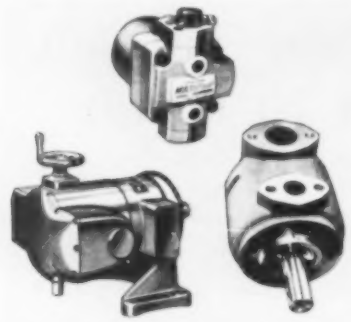


MILLER hydraulic cylinder assures completely safe operation with no-leak construction; reduces hydraulic fire hazards with Pydraul.



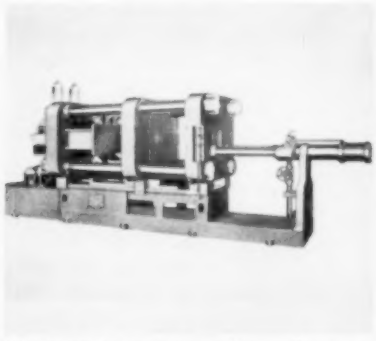
McGRAW-EDISON hydraulic Electromelt furnace lifts, tilts and pours 3000° F. steel safely; reduces hydraulic fire hazards with Pydraul.

SHERIDAN hydraulic press hot-forms titanium and stainless steel to close tolerances; reduces hydraulic fire hazards with Pydraul.

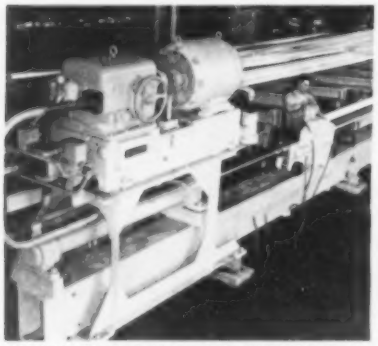


DENISON hydraulic pumps have fewer moving parts and no thrust bearings; reduce hydraulic fire hazards with Pydraul.

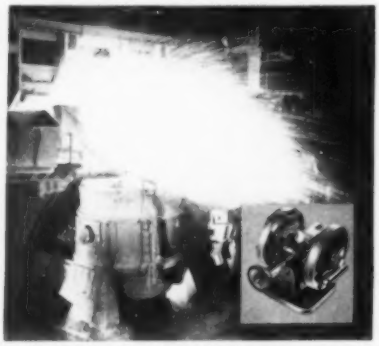
AJAX hydraulic tilt furnace leads field in 60-cycle induction melting; reduces hydraulic fire hazards with Pydraul.



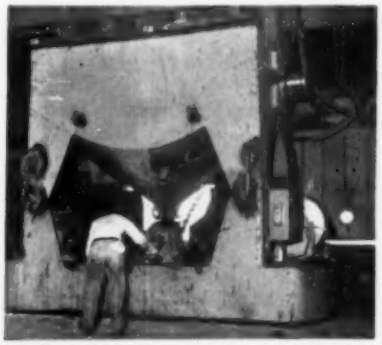
KUX hydraulic die-casting machine produces precision castings of complex parts at high rate; reduces hydraulic fire hazards with Pydraul.



ALUMINUM COMPANY OF AMERICA "pulls" extruded aluminum with hydraulic stretchers; reduces hydraulic fire hazards with Pydraul.



U. S. STEEL controls hydraulic pressures with Askanic Regulators; reduces hydraulic fire hazards with Pydraul.



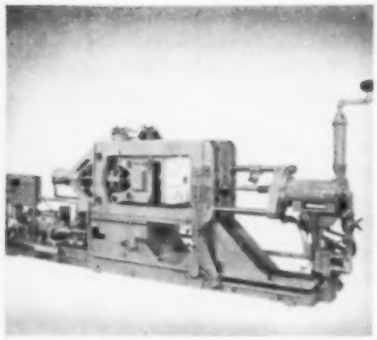
GRANITE CITY STEEL prevents slag from burning through furnace walls with hydraulic Dolomite Slinger; reduces hydraulic fire hazards with Pydraul.

...the hydraulic fluid that lubricates like a premium petroleum oil (but lasts longer), reduces wear and corrosion, spreads time between overhauls and is so stable you may reclaim it simply by filtering. Specify Pydraul for hydraulic equipment wherever flammable hydraulic fluid so much as hints at being a fire hazard. For more information, write for 24-page Pydraul Fact Book and survey sheet on hydraulic fluid hazards, today.

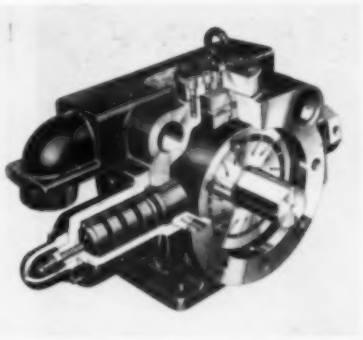
MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, Dept. OEM-16, St. Louis 24, Mo.

PYDRAUL: Reg. U. S. Pat. Off.

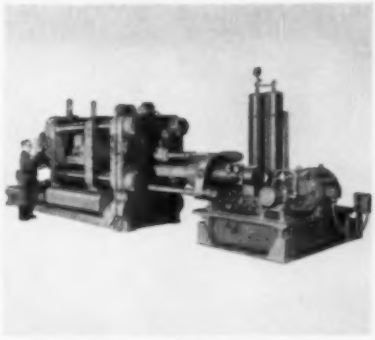
Monsanto



LESTER hydraulic die-casting machine turns out solid machinable, full-measure castings; reduces hydraulic fire hazards with Pydraul.



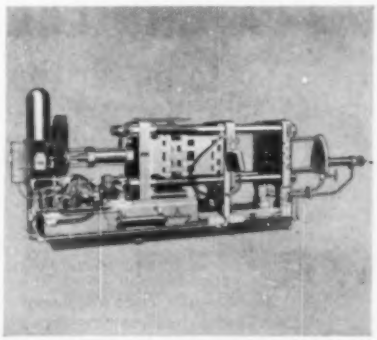
RACINE variable-volume hydraulic pump uses smaller reservoirs and lower horsepower; reduces hydraulic fire hazards with Pydraul.



HYDRAULIC PRESS MFG. CO. die-casting machine features metal injection, cuts scrap loss; reduces hydraulic fire hazards with Pydraul.

MIDWEST PIPING replaces dangerous levers with hydraulic doors for pipe-bending furnace; reduces hydraulic fire hazards with Pydraul.

HANNIFIN hydraulic cylinder features threaded removable cartridge gland for easy lubrication; reduces hydraulic fire hazards with Pydraul.



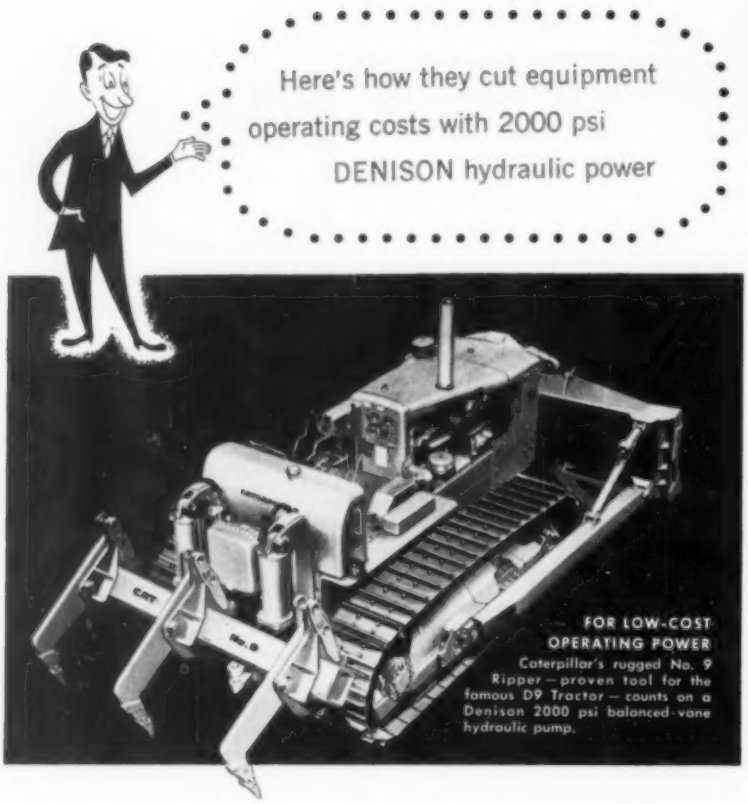
CAST MASTER hydraulic die-casting machine provides extra-heavy linkage with multiple shear points; reduces hydraulic fire hazards with Pydraul.

JOHNSON MOTORS makes engine parts with hydraulic die-casting machines; reduces hydraulic fire hazards with Pydraul.

LISTED UNDER REEXAMINATION SERVICE UL OF UNDERWRITERS' LABORATORIES, INC.

MONSANTO PYDRAUL is the first and only fire-resistant hydraulic fluid listed by Underwriters' Laboratories: "In respect to fire hazard, Pydraul is rated by Underwriters' Laboratories, Inc., 2 to 3 in a class much less inflammable than paraffin (petroleum) oil, according to a schedule in which ether is rated 100; gasoline, 90-100; alcohol (ethyl), 60-70; kerosene, 30-40; paraffin oil, 10-20."

CIRCLE 66 ON TIME-SAVER CARD



Why CATERPILLAR picks DENISON to power the No. 9 Ripper

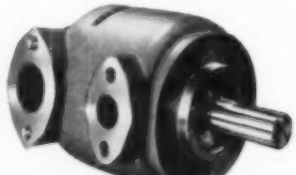
WHY? Because dependable 2000 psi Denison hydraulic power helps Caterpillar build *lower operating cost* and continuous, troublefree performance into its rugged earth-moving units.

Case in point: Here's Caterpillar's No. 9 Ripper—another of many construction units to be factory-equipped with Denison hydraulic equipment. The Ripper's hardworking teeth are powered by a single Denison vane-type pump which provides plenty of reserve "go" for toughest workloads.

Plus benefits: All-weather pump starting without pump damage . . . speedy field servicing . . . less weight . . . less cost-per-horsepower—with a Denison pump as the heart of a hydraulic system.

Caterpillar picks Denison hydraulic equipment for reliability . . . quality . . . proven field performance. It pays off in helping keep Cat® units operating continuously . . . profitably month after month.

Ask your Denison Hydraulic Specialist about how Denison hydraulic power . . . up to 5000 psi . . . can improve performance of your equipment.



2000 PSI HYDRAULIC POWER... *for operating Caterpillar's rugged No. 9 Ripper is delivered by a single Denison "T" series vane pump. Payoff: Jobs get done with trouble-free power to spare for toughest workloads.*

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

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DENISON HydrOILics

CIRCLE 27 ON TIME-SAVER CARD

LETTERS

available space for publication. We do not believe that this simplification detracts from the intent of JIC. As you know, these symbols are developed to make it easy to follow oil flow through a circuit. For the purpose of an article which is to explain the operation of a system, the symbol works very well. For construction or trouble shooting it may present the limitation you have asked about. The actual valve used on this machine is the valve shown in Fig. 2.

NCIH Papers

TO THE EDITOR:

On page 98 of your October issue is a digest of a paper on the subject Water and Oil Removal from High Pressure Gases, given at the NCIH meeting.

Although you mention that at some time in the future these papers will be printed in a volume, is it possible to obtain a reprint of this paper now?

ARTHUR W. GILL
Thom & Gill Advertising
East Orange, N. J.

You can obtain a copy of this article by writing directly to the author or to Raymond Meade, Secretary, National Conference Industrial Hydraulics, Illinois Institute of Technology, 3300 South Federal, Chicago, Ill.

Flow Regulator

TO THE EDITOR:

Could you recommend a supplier for a flow control valve to meet the following conditions: flow rate between 0.1 and 1 gpm of a non-corrosive liquid at temperatures to 150 F and pressures to 50 psi? Sensitivity should be one percent.

C. F. BUSH, Director
G. F. Bush Associates
Princeton, N. J.

A list of flow control valve manufacturers has been forwarded.

Sizing Oil Coolers

TO THE EDITOR:

Many of the people we contact in the hydraulic field with a problem of oil overheating have given little study to the proper method of oil cooling.

For example, a customer calls because the sump temperature is running 200 F, and he wants it 130 F. He knows the oil flow from the pump is 30 gpm. He naturally thinks his problem is to cool the 30 gpm from 200 F down to 130 F, with ambient air at 100 F or city water at 60 F, regardless of whether he has 5 or 100 hp connected to the pump.

This is not correct because he cannot add more heat to the oil than he has hp connected to the system. Also, some of the hp is going into useful work, unless the entire flow at full pump pressure is going over the relief valve.

The hydraulic circuit designer should know what portion of the hp is doing work and what portion is wasted in heat. This involves knowledge of the application, cycling, and surroundings.

Many coolers are selected on the quantity of oil circulated without regard to the temperature at which the oil is to be maintained, temperature of cooling media, or connected hp. Another method is to select a heat exchanger based on the sq ft of surface used on a similar application in the past.

First of all, whether or not a job needs cooling will depend on the design and application of the system.

Secondly, unless heat is added from a source other than connected hp, heat to be removed can't exceed system hp.

Third, you can figure that with natural convection, approximately 1 btu/hr/sq ft of surface/degree F temperature difference will be dissipated from the piping and tank.

Fourth, if a designer wants to select a water-to-oil cooler by rule of thumb, he can assume that he will require 1 sq ft of surface per hp to be dissipated. The heat to be removed will vary from full connected hp, if all oil goes over the relief valve, to 20% if none goes over and the system is 80% efficient. With 1 sq ft of surface per hp to be dissipated, the oil temperature will be maintained between 110 and 120 F, with a water temperature of 80 to 85 F.

D. W. RETZINGER
Manager, Heat Exchanger Div.
Perfex Corp.
Milwaukee, Wis.

Temperature control warrants study from user and designer. We covered this problem in a special report "Temperature Control in Hydraulic Systems" in August 1957. Reprints of this 16-page report are available at 25 cents.

Wants Hydraulic Textbooks

TO THE EDITOR:

Enclosed is a check for $5.00 to cover the cost of your publication Aircraft Hydraulic Design by George Keller and your booklet Air and Oil Circuit Guide.

Further would you send me any information that would be helpful in my classes on aircraft and missile hydraulics? Names of textbooks and other publications would be appreciated.

I am with The Martin Co. and hold classes in hydraulics. APPLIED HYDRAULICS has been extremely beneficial to me.

DARRELL W. PATTON
Littleton, Colo.

Thank you for your nice comments about APPLIED HYDRAULICS & PNEUMATICS *Magazine. We know that many instructors in hydraulics find our publication very valuable.*

Attached is a photostat of a page from our Fluid Power Directory which lists the available textbooks in fluid power. Also attached is a sheet describing the contents of the Directory.

Wants Iris Valve

TO THE EDITOR:

I would be interested in receiving names and addresses of manufacturers of manually operated iris-type valves. I need an 8 in. valve for air at 15 psi and 150 F.

R. BURGAT
Oil Hydraulic Designer
Canadair, Ltd.
Montreal, Canada

Perhaps some of our readers can help you locate manufacturers.

▼▼▼

How you save time and money with

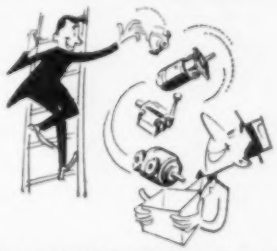
DENISON

Super Market

hydraulic service...

1. BRING US YOUR PROBLEM – *Whatever* hydraulic problem has you stumped. A trained Denison Hydraulic Specialist is ready to help you solve it.

2. WE'LL DEVELOP YOUR CIRCUIT – The most efficient hydraulic circuit to handle your specific needs. We can do this while you wait.



3. PICK OUT WHAT YOU NEED – Right off the shelf–from Denison's complete stock of hydraulic pumps, motors, valves and controls up to 5000 psi.

4. TAKE HOME YOUR COMPLETE HYDRAULIC SYSTEM–Ready to work! Circuit drawings and hydraulic parts are yours in *one complete* package.

in **CHICAGO**

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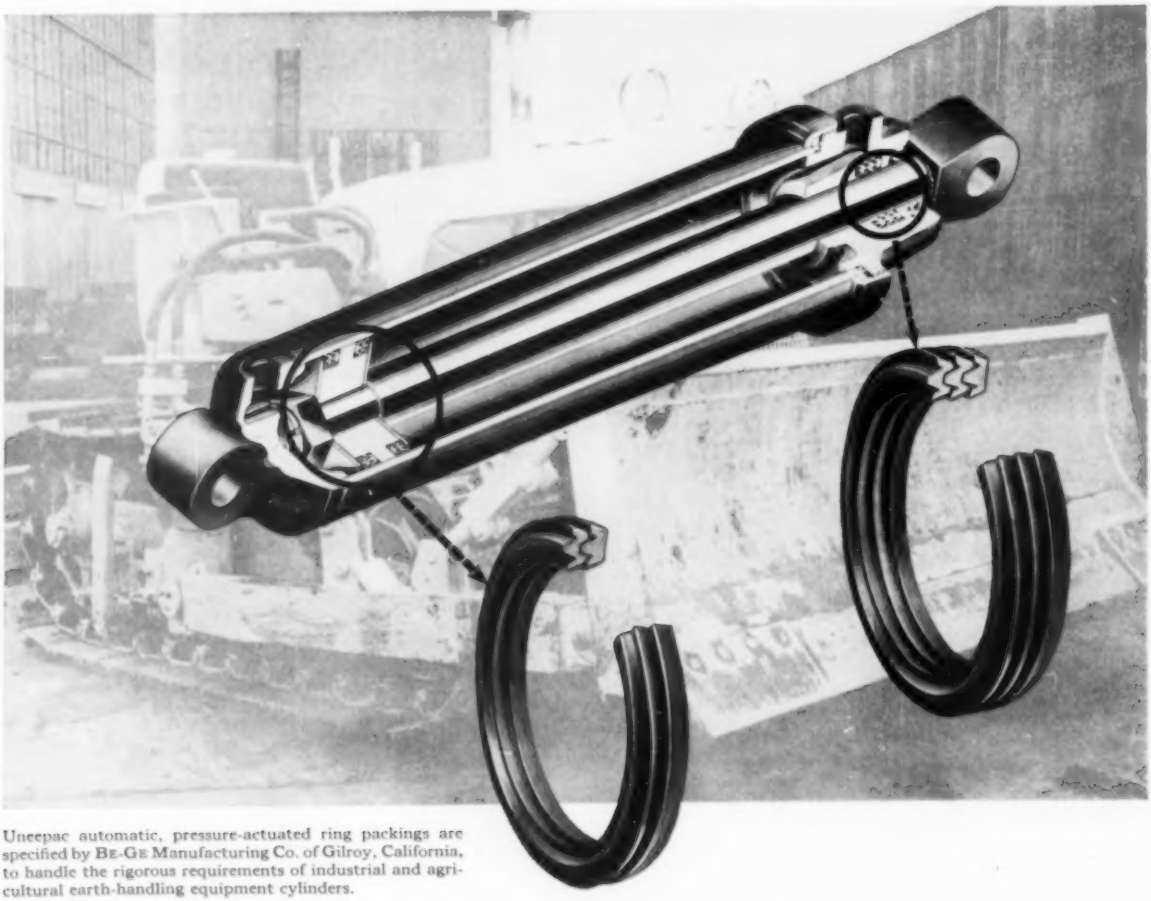
DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

Rigorous tests convinced BE-GE to use J-M Uneepac® in their rugged cylinders



Uneepac automatic, pressure-actuated ring packings are specified by BE-GE Manufacturing Co. of Gilroy, California, to handle the rigorous requirements of industrial and agricultural earth-handling equipment cylinders.

Uneepac proves it can handle shock pressures to 4,000 psi in three-year, life-test program

• BE-GE Manufacturing Company's line of cylinders for their hydraulic systems has to stand up to years of day-in, day-out abuse. That's why BE-GE engineers subjected J-M Uneepac Rod Packings to a 350,000-cycle test and Uneepac Piston Packings to a 150,000-cycle test in a three-year program that proved Uneepac can take working pressures to 2,500 psi—shock pressures to 4,000 psi. As proof of performance, Uneepac is now the specification packing on all BE-GE standard—and heavy-duty cylinders.

Pressure-actuated Uneepac Rings offer high-efficiency sealing in minimum packing depth. Each ring provides an efficient, individual seal—nests with adjacent rings in an interlocking manner without compression adjustment for true, multiple-ring action.

With Uneepac, you can achieve high-efficiency sealing with fewer rings, smaller stuffing boxes. For quick, easy installation, Uneepac rings are self-centering, self-adjusting. Make it a point to consider Uneepac Rings for every application requiring top packing efficiency and life.

Uneepac rings are available in all standard materials in a wide range of sizes for most rod and plunger applications. For further information, write to Johns-Manville, Box 14, New York 16, N. Y.

J-M Clipper Seals—used as rod wipers in BE-GE cylinders—keep dirt out.

JOHNS-MANVILLE

CIRCLE 53 ON TIME-SAVER CARD

DYNAMIC DIFFERENCE
in hydraulic performance

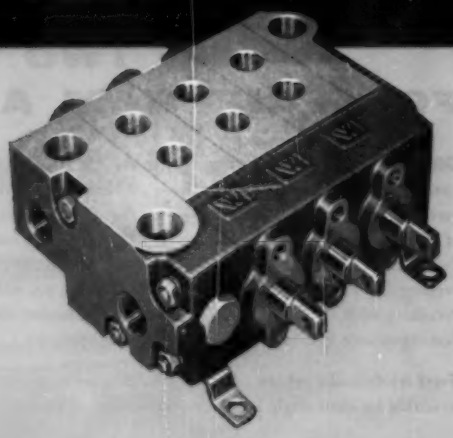
Webster
DIRECTIONAL CONTROL VALVES

Combines to culvert cleaners — anywhere one, two or more hydraulic applications are handled at one time . . . *the difference is dynamically apparent when Webster is on the job!* Versatile! Parallel design permits control of up to 6 independent circuits. Range! Operating pressures to 2000 psi — shock pressures to 5000 psi. Lowest back pressure. Compact! Smallest size for rating. Three sizes — single spool type in 20 gpm capacity, parallel stacked in 20 and 40 gpm capacities.

You find Webster Directional Control Valves on leading agricultural, road building and industrial machines. Chances are there's a size and model ideally suited for your product — for the dynamic difference that pays!

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC
MELROSE 3-3511
RACINE · WIS



DESIGNED FOR PEAK PERFORMANCE

- Alloy steel spools — heat-treated, precision-ground.
- Fully balanced at all pressures.
- Stack valves have throttling grooves in spools for smooth, gradual flow.
- Inlet and outlet connections can be made to the same end of the valve assembly to simplify hook up.
- Alternate porting positions provided for flexibility in application.

Call the man from Webster

. . . he's one of a staff of engineers, specially trained in hydraulic application. He can help you solve special problems when hydraulics become a part of your design!

CIRCLE 107 ON TIME-SAVER CARD

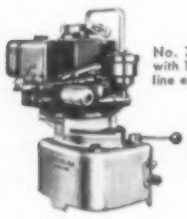
Up to 10,000 psi,
6,000 psi continuous

No. 798-AC Power Pump with ¾-hp, 115-230-volt a-c electric motor

TWO SPEEDS FOR FAST RAM APPROACH!

GREENLEE NO. 798 Portable Power Pumps eliminate nearly all the time loss accumulating while operators of hydraulic devices wait for the ram to contact the work! If you specify pumps for hydraulic rams, jacks, presses, or other systems, be sure to learn the details of this *exclusive* advantage and numerous other advance features of GREENLEE No. 798 Power Pumps capable of developing continuous pressure of 6,000 psi and up to 10,000 psi intermittent pressure. Delivery rate at 1,000 psi, 36 cubic inches per minute; at 10,000 psi, 28 cubic inches. Available with 115-230-volt a-c or 115-volt ac-dc motor; also with gasoline engine. All deliver fast dependable hydraulic power with superior efficiency.

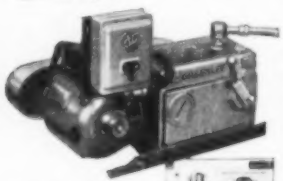
Fast hydraulic return of ram is available in every type GREENLEE Power Pump! All pumps available for *either* single-action or two-way-action rams.



No. 798-GM—with 1.7-hp gasoline engine

No. 798-CO—with ½-hp, 115-volt ac-dc universal electric motor

No. 797-E—with choice of 2-hp or 3-hp a-c electric motor, delivering 106 or 213 cu in. of oil per min. Also available with gasoline engine.



TOOLS FOR CRAFTSMEN
GREENLEE

WRITE, or simply attach this page to your letterhead, for illustrated data sheets giving applications, features, and specifications of GREENLEE No. 798 Pumps.

GREENLEE TOOL CO., 2452 HERBERT AVE., ROCKFORD, ILLINOIS, U.S.A.
CIRCLE 42 ON TIME-SAVER CARD

FUTURE EVENTS

January 12-16, 1959: SAE Annual Meeting, and Engineering Display. Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

January 26-29: Tenth Annual Plant Maintenance and Engineering Show. Public Auditorium, Cleveland, Ohio.

February 2-6: Material Handling Exposition and Conference. Automotive Building, Toronto, Canada.

March 19-20: SAE National Production Meeting. The Sheraton-Cadillac Hotel, Detroit, Mich.

March 31-April 3: SAE National Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display. Hotel Commodore, New York, N. Y.

April 14-15: Tenth annual Earthmoving Industry Conference. Peoria, Ill. Sponsored by Central Illinois Section, SAE.

April 20-24: SAE A-6 Aircraft Hydraulic and Pneumatic Meetings, Cleveland, Ohio.

September 14-17: National Farm, Construction, and Industrial Machinery Meeting, Production Forum, and Display. The Ambassador, Los Angeles, Calif.

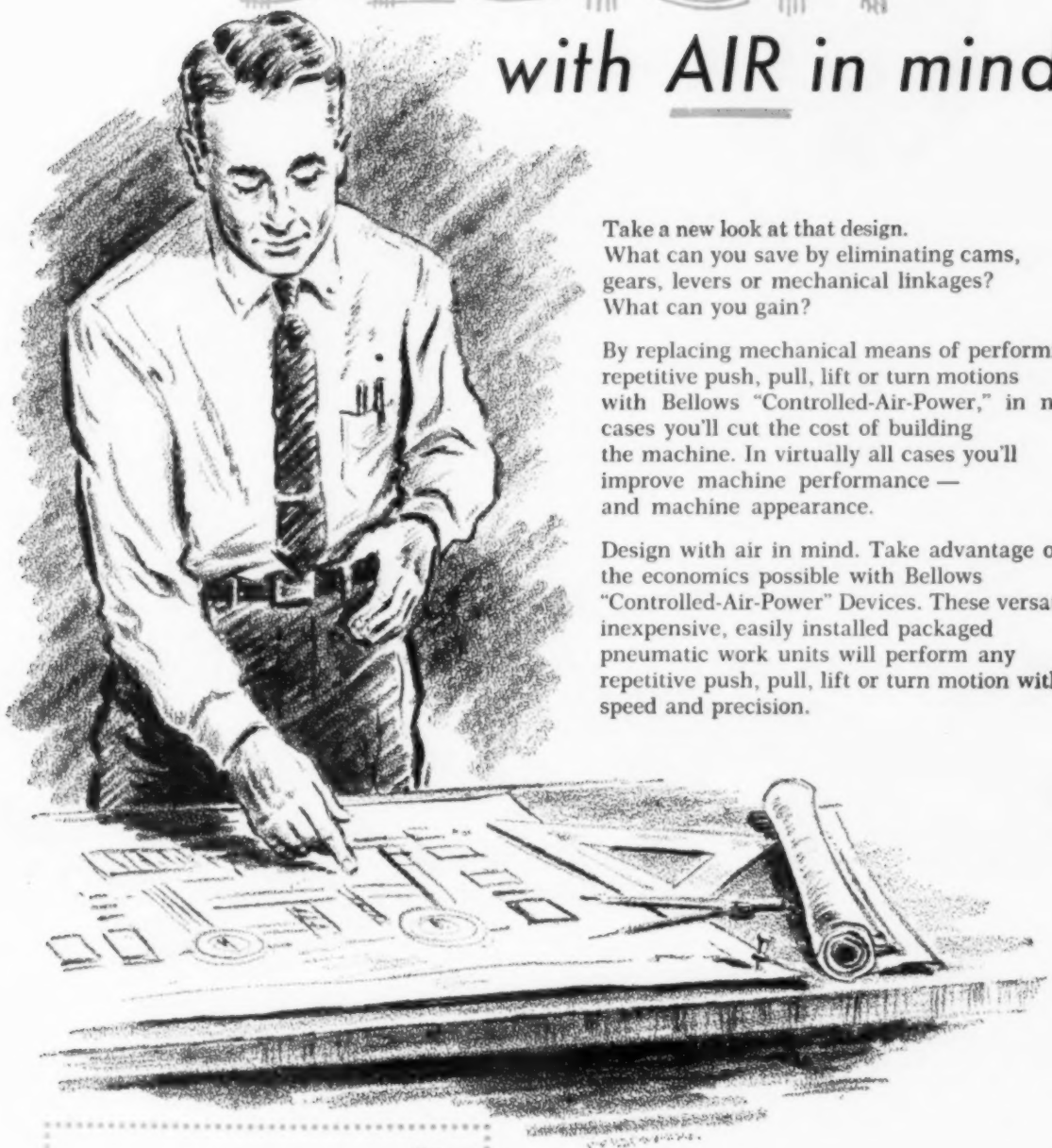
October 5-10: SAE National Aeronautic Meeting, Aircraft Manufacturing Forum, and Aircraft Engineering Display. The Ambassador, Los Angeles, Calif.

▼▼▼

coming in:
FEBRUARY 1959
Servo Issue
APPLIED HYDRAULICS & PNEUMATICS
Design and Application of Servo Components and Systems

DESIGN

with AIR in mind



Take a new look at that design. What can you save by eliminating cams, gears, levers or mechanical linkages? What can you gain?

By replacing mechanical means of performing repetitive push, pull, lift or turn motions with Bellows "Controlled-Air-Power," in most cases you'll cut the cost of building the machine. In virtually all cases you'll improve machine performance — and machine appearance.

Design with air in mind. Take advantage of the economics possible with Bellows "Controlled-Air-Power" Devices. These versatile, inexpensive, easily installed packaged pneumatic work units will perform any repetitive push, pull, lift or turn motion with speed and precision.

READ THIS STORY—

"The Place of the Bellows Air Motor in Original Equipment Design."

This new 14 page booklet will be of help to any design engineer.

Write Dept. AH1258, The Bellows Co., Akron 9, Ohio

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario

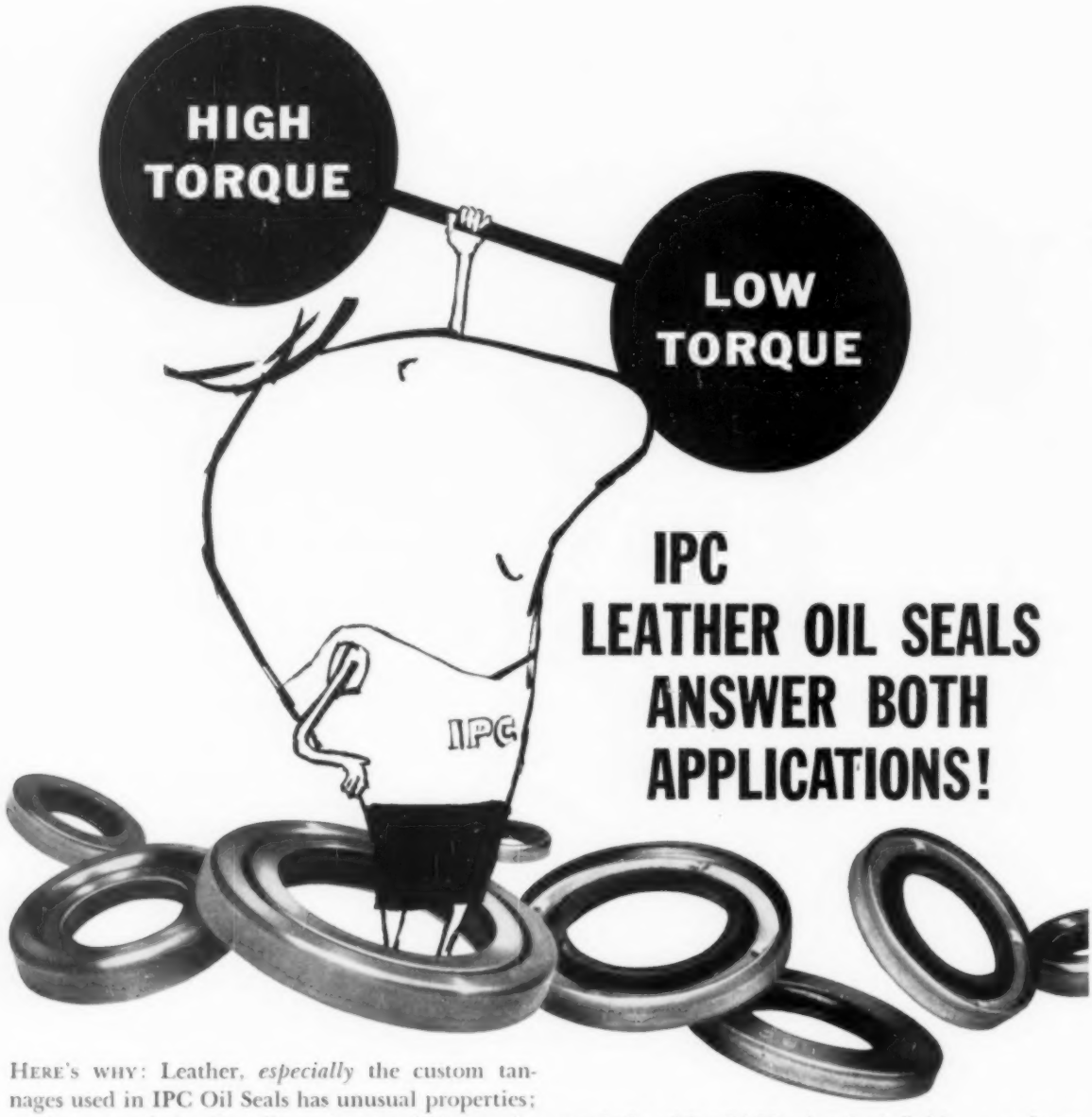
The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

893-8

CIRCLE 15 ON TIME-SAVER CARD



IPC LEATHER OIL SEALS ANSWER BOTH APPLICATIONS!

HERE'S WHY: Leather, *especially* the custom tannages used in IPC Oil Seals has unusual properties; . . . for example it offers dimensional stability, *and a great torque range* . . . with the result that IPC Leather Oil Seals meet torque conditions from minimum up to 2-3 times normal.

IPC Leather Oil Seals have high abrasion resistance . . . are ideal for slow speed applications on rough shaft finishes (up to 60 micro-inch). Where higher speeds are a factor, IPC Leather Seals are performing well at speeds up to 2000 feet per minute . . . on shafts with a 24-32 micro-inch finish . . . and temperatures up to 248° F.

How about low friction? . . . The IPC Leather Oil Seal has a distinctive edge . . . can be furnished with numerous types of treats or impregnates tailored to solve your specific problem.

Why not look into IPC Leather Oil Seals soon? This custom approach to sealing problems is your best assurance of quality.

Packings
Oil Seals
Precision Molding

IPC **INTERNATIONAL PACKINGS** CORPORATION

Custom designed . . . for your application.

Bristol, New Hampshire P-6

CIRCLE 51 ON TIME-SAVER CARD

from Skinner in '58

...these answers to your control "puzzles"

L **NEW two-way valve for high flow industrial applications**

At greatly reduced cost, this larger pilot-operated valve permits applications not possible before. Designed for air, oil, water. Features ½" orifice with ⅜" or ½" NPT ports, ¾" orifice with ¾" NPT ports, 1" orifice with 1" NPT ports. Pressure differentials: 5-150 psi. Body is naval forged brass. Diaphragm is fully supported. Available in standard and Explosionproof construction, normally open or normally closed.

A **NEW three-way valve for medium-sized cylinders**

Available normally open, normally closed, directional control and multi-directional, with 5/32" inlet and 5/32" exhaust orifices and ¼" NPT ports. Designed to control air, oil and inert gases. Handles pressures to 125 psi. Body is non-corrosive zinc. Internal parts are stainless steel.

LC **NEW two-way, low-cost, pilot-operated valve**

A smaller, lighter, normally closed valve. Permits full flow through ½" orifice with ⅜" or ½" NPT ports. Will control all common media: air, oil, water, etc. Pressure differentials: 5-150 psi. Forged naval brass body. Uniquely designed diaphragm – fully supported.

R **NEW two-way valve for standard and high pressure applications**

A big capacity, pilot-operated valve with a ¼" orifice and ¼" NPT ports. Designed to control air, water, oil, semi-corrosive materials. Long-lasting, stainless steel internal parts. Forged naval brass body. Available normally open or normally closed. Standard models operate on pressure differentials of 5-200 psi; high pressure normally closed models on 5-1250 psi.

For complete information, please contact our Representative or Distributor near you . . . you'll find him listed in the yellow pages or write us at the address below, Department 31D.

SKINNER ELECTRIC VALVES
THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION
NEW BRITAIN CONNECTICUT
105 EDGEWOOD AVENUE

CIRCLE 89 ON TIME-SAVER CARD

BRIEFS

about fluid power

ENGINEERS GET SYSTEMS IDEAS AT NCIH

CHICAGO, Oct. 16, 17—Missiles were the highlight of the 14th Annual National Conference on Industrial Hydraulics. First to be introduced by Ralph King, Conference Director, was Major General D. N. Yates, commander of the Air Force Missile Test Center, Patrick Air Force Base, Florida. General Yates told of the function of the test center, its physical layout and organization. Most of the people in the operation are civilians. The General's talk, illustrated by colored slides and movies, described some unsuccessful as well as successful missile launchings.

Kurt Stehling, head of propulsion for the Navy's Vanguard missile, gave the group a look at the inside of the Vanguard and the precise design necessary to success. Either under-design or over-design can be disastrous. Stehling described applications of fluid power on a missile.

Subjects at the technical sessions ranged from aircraft to heavy press hydraulic systems. The degree of complication of the papers covered about as wide a range. Some systems and their performance were analyzed mathematically, in very detailed fashion.

• **Aircraft**—Supersonic flight and carrier landing speeds call for rearrangement of the air foil contour on Chance-Vought's F8U-1 Crusader. Hydraulics is used to

Continued on page 26

Ralph J. King, Conference Director, 14th NCIH, opens the meeting.

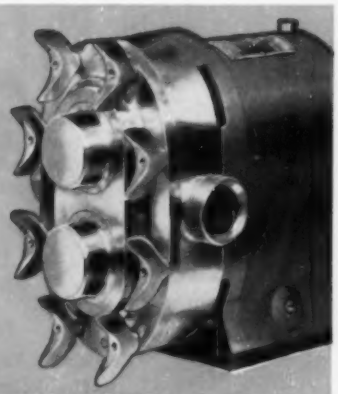
1958 PRIZE WINNERS ACCEPT AWARDS

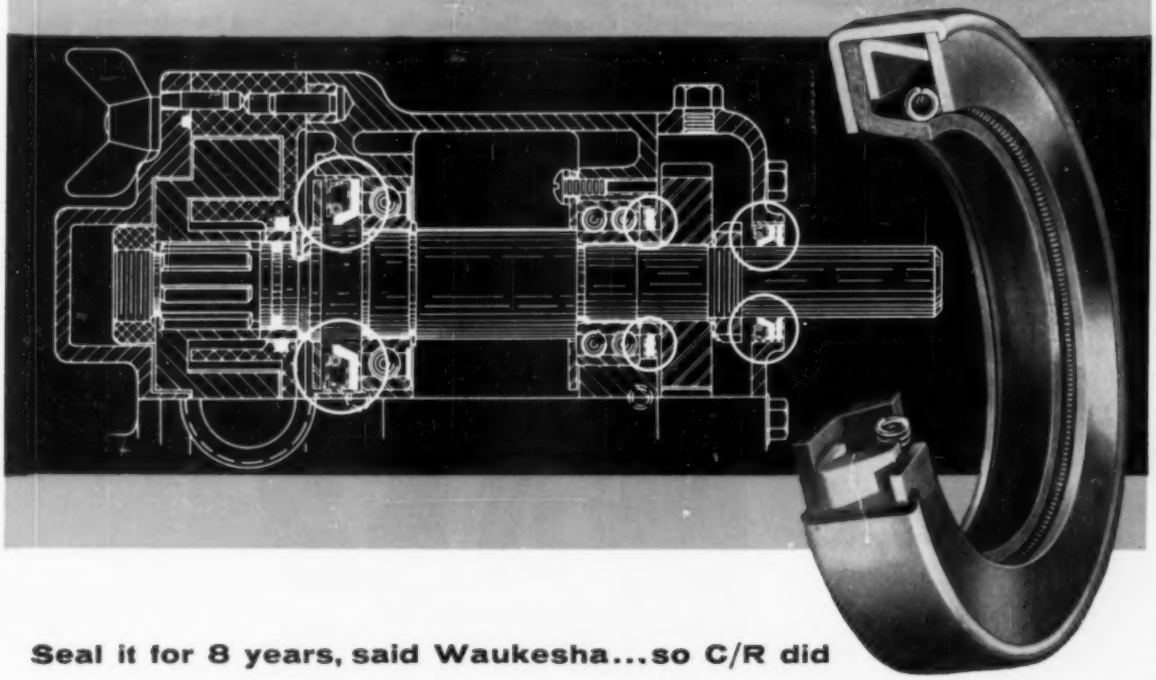
AWARD PRESENTATION—From left to right: Ted Snow, Boeing Airplane Co., who accepted the Second Award for E. T. Raymond and J. W. Hull; Paul Bosen; Paul Rolnick; Kenneth S. Knapton, Jr.; and conference directors Ralph King and R. Q. Sharpe.

For the sixth year, presentation of the top awards in APPLIED HYDRAULICS AND PNEUMATICS' Prize Paper Contest were made at the NCIH. Top money, $500.00, went to the team of Paul Bosen and H. Cutler for their "Solving Design Problems on a Special Machine." Second Award of $300.00 was split by E. T. Raymond and J. W. Hull of Boeing Airplane Co. Their subject: "Aircraft Reliability Demands Leakproof Hydraulics." Kenneth S. Knapton, Jr., Sanders Associates, Inc., got the $200.00 third prize for his "From Missiles to Road Graders."

Awards were made by Paul Rolnick, Editor, APPLIED HYDRAULICS AND PNEUMATICS, at the opening session of the NCIH on Thursday morning, October 16.

WAUKESHA PUMP SEALS CHECKED OUT FOR 20,000 trouble-free hours





Seal it for 8 years, said Waukesha...so C/R did

"And, we might add, we have had very, very few instances of failure with C/R Oil Seals," says Mr. Gilbert R. Funk, Vice President, Pump Division of the Waukesha Foundry Co. Long service life is only one of the requirements met by the C/R Types P, G and A Oil Seals in this Waukesha Sanitary Pump. They must seal effectively eight hours a day, six days a week for eight years . . . at shaft speeds up to 750 r.p.m., with pump head pressures up to 150 p.s.i., and temperatures ranging from 0° to 220° F., depending on the food material pumped. They also must resist food acids, and the acids and alkalies in the commercial detergents used to cleanse and flush the pump daily. An added indication of C/R Oil Seal dependability in the Waukesha Sanitary Pump is the fact that it constantly must meet rigid 3-A Sanitary Standards for the Dairy and Food Industries.

If you have a sealing problem . . . equally critical . . . or simple . . . bring it to Chicago Rawhide. C/R engineers will help you select the correct oil seal for your application from stock . . . or cooperate with you on special designs.

More automobiles, farm and industrial machines rely on C/R Oil Seals than on any similar sealing device.

OIL SEAL C/R DIVISION

CHICAGO RAWHIDE

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue Chicago 22, Illinois

Offices in 55 principal cities. See your telephone book.

In Canada: Manufactured and Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Brantford, Ontario

Export Sales: Geon International Corp., Great Neck, New York

Other C/R Products
Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

CIRCLE 21 ON TIME-SAVER CARD

Air — 150 psi
Hydraulic up to 1500 psi
Meet JIC Standards

Fit like a hand in a glove where space is limited

O-M *Internal Key Round-Line Cylinders, Air and Hydraulic*

THAT'S why this O-M original Round-line of Cylinders, that fit where others won't, is widely specified by design engineers when space, weight and streamlining are important.

There are other advantages in using these powerful, compact components. For example, they are of all-steel construction with bearing surfaces of bronze, have the lowest coefficient of friction of any cylinder, and deliver continuous, smooth, dependable power at low or high speeds.

In addition, they are simple to install and service. The end plugs are tapped for universal mounting, and the ports can be oriented to any position. These cylinders are quickly and easily modified to fit special applications.

Available in a complete range of sizes (1½" to 8" bores) with standard 2 to 1 or oversize rods. Also full line of mounting brackets interchangeable bore for bore. Immediate delivery on many sizes.

Write today for catalog 101A.

ORTMAN-MILLER MACHINE CO.

1 143rd Street, Hammond, Indiana
☐ Have representative call
☐ Send Bulletin 101A

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CIRCLE 68 ON TIME-SAVER CARD

BRIEFS

vary wing incidence as well as move portions of the wing to change the airfoil section from a streamlined, low-drag low-lift section for high speeds to a deeply undercambered, high-lift section for takeoffs and landings. Details of these systems were given by J. H. Ballantoni of Chance-Vought Aircraft in his paper "Design Features of the Crusader Hydraulic System." He also pointed out that hydraulic power requirements on one of today's fighter aircraft are about ten times those of its World War II counterpart.

• **Give Him Air**—This is Charles H. Cannon's reaction to what will be used in the fluid power systems of coming aircraft which will operate at 1000 F or more. Requirements of future fluid power systems and properties of various fluid power media were compared by Cannon of Lockheed-Marietta in his paper "Research on High-Temperature Hydraulic and Pneumatic Systems for Aircraft. He admits that there may be a dark horse somewhere that will do a better job, but right now, it looks like air.

Floating on air is just what you do if you're in a car with a pneumatic springing system. Arnold Nordgren and Franklin Wisman of Bendix Products Div., Bendix Aviation Corp. told of the advantages of the Bendix System in their "Hydropneumatic Vehicular Suspension."

• **Why Not Standardize**—Lack of standardization in the fluid power industry makes life difficult for the machine designer, says William E. Van Horn, chief engineer, Hydraulic Power Div., Hydraulic Press Mfg. Co. In his paper, "Responsible Engineering for Performance and Maintenance," Mr. Van Horn pointed out that it's awfully difficult to pick out a pump, valve, and cylinder that will all work with the same hydraulic fluid, the way different manufacturer's fluid recommendations read.

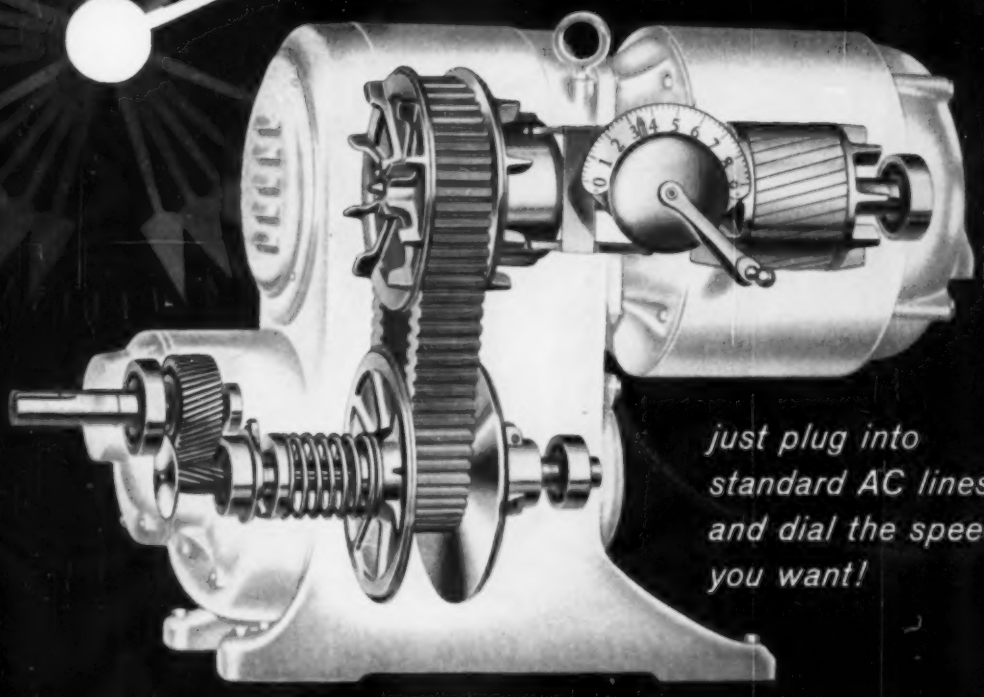
Continued on page 28

Frank Mackin, General Motors Institute; Jim Greenlee, Imperial Brass Mfg. Co.; Don Strandberg, Anchor Coupling Co. Inc.; and Steve Abel of Norman Engineering meet between sessions at the 14th NCIH.

Discussing a paper given at the pump session are, from left to right, George Geiger, Hydraulic Power Div., Hydraulic Press Mfg. Co.; W. E. Van Horn of the same company; W. J. Kudlaty, Flick-Reedy Corp.; and Jack Frink of Flick-Reedy.

Nonek-matic Valves

any RPM simply on AC!



just plug into standard AC lines and dial the speed you want!

U. S. VARIDRIVE Motors

...one unit...infinite speeds!

So *simple* to get any speed you want, directly from standard AC power lines—with U.S. VARIDRIVE MOTORS! One compact, self-contained unit does it. With U.S. VARIDRIVE, you don't have to buy a DC converter, DC generators, complicated and delicate electronic circuits. Just *plug in* this one simple unit—dependable, easy for your regular personnel to maintain. You merely dial, and get smooth, stepless speed changes immediately! Thus, you set speeds for maximum production as needs vary...*increase* machine efficiency...output...product quality! *Decrease* costs...rejects...manpower and materials waste! Available in RATINGS: ¼ to 60 H.P. Specify: "U.S. VARIDRIVE MOTOR."

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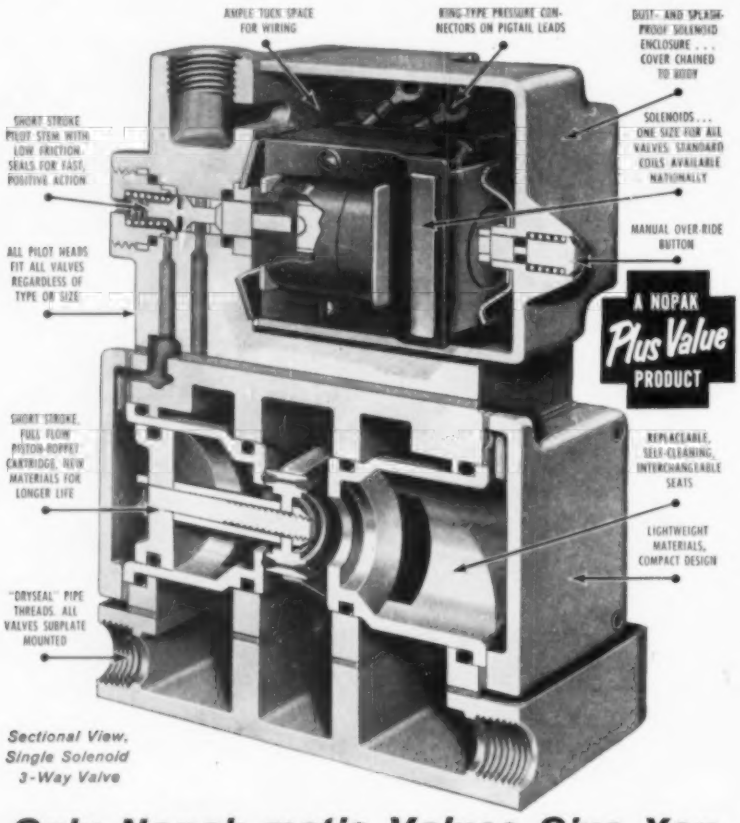
... Send for U.S. Varidrive Bulletin No. 1797

CIRCLE 98 ON TIME-SAVER CARD

Nopak-matic Valves set

New Standards of Precision Control . . . in Air Cylinder Operation


AMPLE TUCK SPACE FOR WIRING
RING-TYPE PRESSURE CONNECTORS ON PIGTAIL LEADS
DUST- AND SPLASH-PROOF SOLENOID ENCLOSURE . . . COVER CHAINED TO BODY
SOLENOIDS . . . ONE SIZE FOR ALL VALVES. STANDARD COILS AVAILABLE NATIONALLY
MANUAL OVER-RIDE BUTTON
SHORT STROKE PILOT STEM WITH LOW FRICTION SEALS FOR FAST, POSITIVE ACTION
ALL PILOT HEADS FIT ALL VALVES REGARDLESS OF TYPE OR SIZE
A NOPAK Plus Value PRODUCT
SHORT STROKE, FULL FLOW PISTON-POPPET CARTRIDGE, NEW MATERIALS FOR LONGER LIFE
REPLACEABLE, SELF-CLEANING, INTERCHANGEABLE SEATS
LIGHTWEIGHT MATERIALS, COMPACT DESIGN
"DRYSEAL" PIPE THREADS. ALL VALVES SUBPLATE MOUNTED

Sectional View, Single Solenoid 3-Way Valve

Only Nopak-matic Valves Give You ALL of these PROVEN Plus Values

- *"Flow Director" Pilot Head* — simplifies piping . . . 3-Ways operate Normally Open or Normally Closed; choice of two inlets on 4-Ways eliminates criss-cross piping.
- *3 Pilot Heads Fit all Models* — are completely interchangeable on all valves, regardless of type or size.
- *100% J.I.C. Conformance* — a Complete Line of pilot operated Air Control Valves . . . that meet or exceed all J.I.C. recommendations . . . *at no extra cost!*
- *Fast Maintenance* — complete valve assembly can be replaced *in less than 2 minutes*, without disturbing piping.
- *Replaceable, Self-Cleaning Seats* — fast and inexpensive to replace. Only two size seats fit all valves and are completely interchangeable within the valve or with other valves.
- *Fast Action* — valve shifts in less than 18-thousands of a second.

Available in ¼" thru ¾" pipe sizes for 3-Way and 4-Way operation with air, single or double solenoid pilot.

For the complete Nopak-matic Story, see Catalog 105

Representatives in Principal Cities

NOPAK ***VALVES and CYLINDERS***

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CIRCLE 38 ON *TIME-SAVER CARD*

BRIEFS

Lack of interchangeability is also a problem. Designers and users don't like components that can't be quickly replaced with another manufacturer's product. When questioned about interchangeability, one prominent automobile manufacturer said that pumps were the biggest problem. Some program to standardize fluid and temperature specifications, envelope sizes, port sizes, etc. is a real need according to Mr. Van Horn.

• **Bearings for F-R Fluids**—Among the many interesting reports of successful operation with fire-resistant fluids was one by William Adamek, Jr. of Fisher Body Div., General Motors Corp. Life of pressure-compensated vane pumps used on spot-welding machines with water-glycol fluid was lengthened by using bronze sleeve bearings instead of standard anti-friction bearings. Another modification to a similar pump eliminated air being sucked into the pump past the shaft seal and mixing with the fluid.

HYDRAULIC TRIP releases the cables on this pulpwood loading attachment for lift trucks. It is used for loading logs onto railway cars and has a 132-in. outreach. When the load is deposited, the sling hooks are released by a hydraulic cylinder. Hooks are reset on the return stroke of the cylinder. Attachment is built by Yale & Towne Mfg. Co., Philadelphia.

• **Oil-Filled Solenoids**—Longer life and quieter operation are a

Continued on page 30

NEW HIGH PRESSURE FLUID POWER FOR MOBILE EQUIPMENT . . . .

DESIGNERS . . .

Investigate the Advantages of Low Cost, Long Service Life and High Pressure Operation on Mobile Equipment!

HYDRECO®

Series 2100 GEAR PUMPS

16 to 32 gpm at 1800 rpm
Operating Pressures to 2000 psi
40 gpm at 1800 rpm
Operating pressures to 1500 psi

Designed to cover a broad range of difficult applications, such as: heavy duty earth moving, road building and materials handling equipment. They feature four design advances that add up to . . . *More Duty Hours at Top Volumetric Efficiency and Minimum Cost.*

- Piloted housing and end covers eliminate shifting.
- Thrust bearing – to take axial thrust of hydraulic forces.
- Two-stage seal – runs cooler – lasts longer.
- Improved shaft bearings – tolerate increased loading.

The 2100 Series of HYDRECO Gear Pumps embraces heavy duty applications in the range immediately below that covered by the famous HYDRECO 3000K Series. Thus, with the 2100 and 3000K Series engineers have a broad selection of sizes in Hydraulic Pumps with established history of high performance and dependability.

Member NFPA

Write – for full information on Series 2100 and Series 3000K Gear Pumps.

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Please send me latest bulletins on HYDRECO Series 2100 and Series 3000K Hydraulic Pumps.

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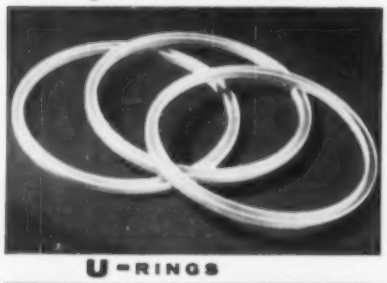
CIRCLE 50 ON TIME-SAVER CARD

V-RINGS

PISTON RINGS



U-RINGS

FLANGES

CUPS

Chemiseal® hydraulic seals . . .

MADE OF
du Pont
TEFLON

Chemiseal hydraulic packings are made for every type of static and dynamic seal. They are available in pure TEFLON or in Filled TEFLON (glass, graphite, etc.) depending upon the application and service requirement.

Preferred by Leading Engineers

Because Chemiseal hydraulic seals provide the reliability of chemically impervious TEFLON, they are preferred by leading engineers for maximum security at vital points in aircraft and missile, automotive, marine, ordinance and industrial hydraulic systems.

Outstanding Advantages

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They offer unsurpassed antifriction properties, are tough, resilient, non-flammable, long wearing. They function equally well at any temperature from 100 degrees below zero to 500 degrees above.

Write for further information and samples for test.

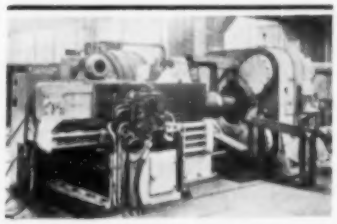
United States Gasket Co.
Camden 1, N.J.

United States Gasket *Plastics Division of* **GARLOCK**

CIRCLE 99 ON TIME-SAVER CARD

BRIEFS

couple of the advantages of solenoids for valve operation that are completely immersed in oil. E. A. Viale, vice president, Detroit Coil Co., told how their oil-filled solenoids are constructed and compared performance with those operating in air. A. B. Huntington, chief engineer, Ross Operating Valve Co., and P. B. Olmsted, vice president research and development, Double A Products Co. told of their experience with these solenoids. It was all good.

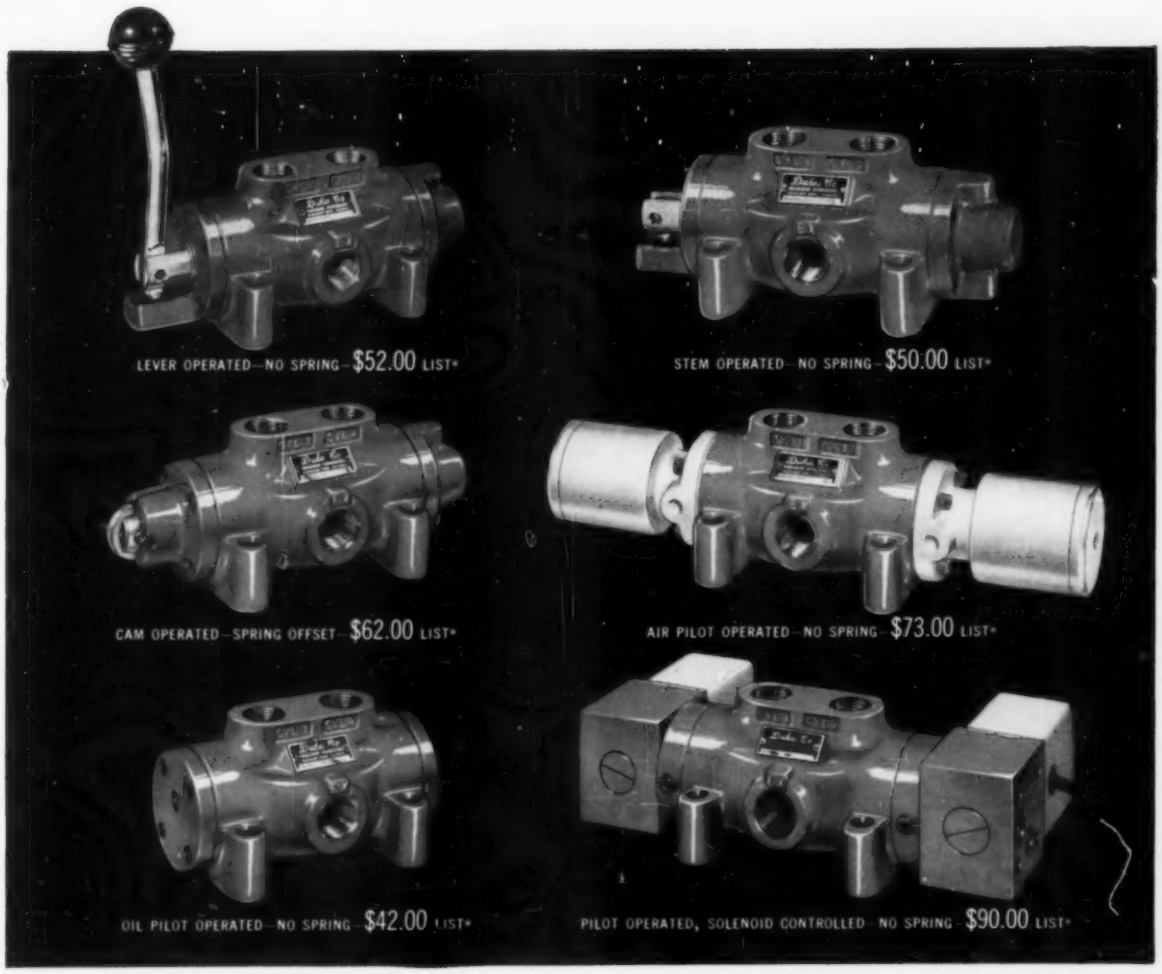


HORIZONTAL RADIAL FORGING machine hydraulically operated and tracer-controlled is capable of forging solid and hollow pieces to 10⅝ in. dia and 71 in. long. Tolerances for hot work can be held to .012 in. and even lower for cold work. The machine was built by Gesellschaft fur Fertigungstechnik und Maschinenbau M.B.H. Steyr, Austria. It is being used to forge pipe couplings.

• **Numerical Control Made Easy**—Numerically-controlled machines need only be as complicated as the parts they produce, according to Justin Wright, Project engineer, Jones & Lamson Machine Co. While it's true that these machines can be complicated and preparation of the tape may require elaborate computer equipment, the part produced then will have complex, curved surfaces. A machine with straight-line motions is quite simple and the tape can be prepared with a simple hand punch more easily than a cam can be designed.

• **Proceedings**—Complete papers will be published in book form early in 1959. Copies of the 14th annual NCIH proceedings, can be ordered from R. D. Meade, Conference Secretary, Illinois Institute of Technology, 3300 S. Federal, Chicago, Ill. ▼▼▼

Continued on page 32


LEVER OPERATED—NO SPRING—$52.00 LIST*
STEM OPERATED—NO SPRING—$50.00 LIST*
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CHECK the prices! COMPARE the specs!

You'll find this NEW line of valves costs less and operates to higher requirements

. . . and TANDEM SPOOLS are available at no extra cost

- Available for pressures up to 3000 PSI
- Choice of 4 spool actions: spring centering, spring offset, no spring in detent or friction pad type
- Choice of 3 standard spools and 5 alternates
- National Acme solenoids
- Full area internal porting
- ½" and ¾" pipe sizes

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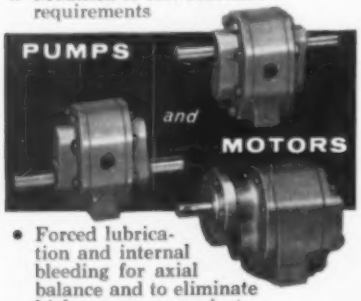
Precision Engineered Hydraulic Equipment

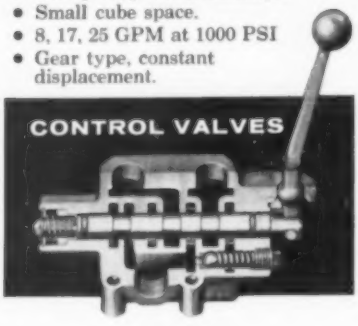
. . . by the World's Largest Builders of Hydraulic Jacks . . .

NEW, LOW COST MANUAL HYDRAULIC PUMP FOR AGRICULTURAL OR LIGHT INDUSTRIAL EQUIPMENT

- ★ Stroke 2⅜"
- ★ Maximum Operating Pressure 1500 PSI
- ★ Fluid Capacity .966 gallon with tank ⅔ full
- ★ Weight 22 lbs.
- ★ Overall Height 21"
- ★ Handle Length 20" overall. 17½" pipe handle
- ★ Mounted to suit customer requirements



- Forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals.
- Rotate in either direction.
- Heavy-duty roller bearings.
- Small cube space.
- 8, 17, 25 GPM at 1000 PSI
- Gear type, constant displacement.



- Large oil passages.
- Close grained, high tensile alloy body castings.
- 2 types of action.
- Spring centered, ball detent hold.
- Hardened ground spool.
- Precision honed valve body.
- Pressure relief valve.
- Hardened seat insert for long life.

Hein-Werner Corporation Waukesha Wisconsin

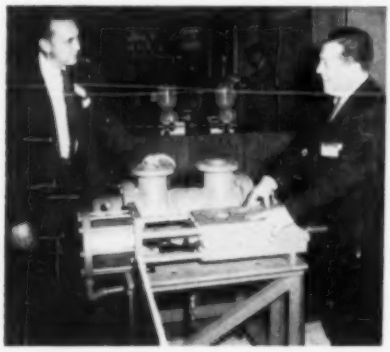
HEIN-WERNER CORPORATION
WAUKESHA, WISCONSIN
CIRCLE 45 ON TIME-SAVER CARD

BRIEFS

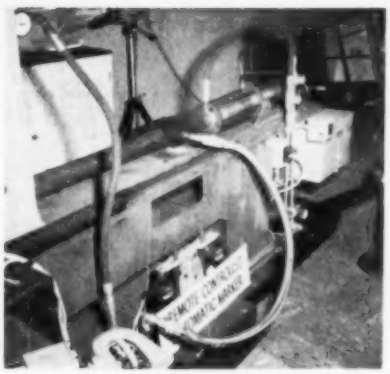
Making Steel With Fluid Power

How does the steel industry use fluid power? Here are four ways exhibited at the recent Iron & Steel Exposition in Cleveland.

FOUR OPERATIONS in web processing are controlled by jet pipe hydraulic amplifiers. They regulate payoff, tension, speed, (with flyball governor sensing) and windup. Pressure range to 750 psi.
NORTH AMERICAN MANUFACTURING CO., CLEVELAND, OHIO



BIG VALVE for 5000-psi service is packed-plunger type. Two-inch, 4-way valve is rated at 55 gpm with 20 fps velocity. It's operated by an 8-in. air cylinder.
HUNT VALVE CO., SALEM, OHIO



PNEUMATIC MARKER has an 8 x 14 in. cylinder to actuate the marking rollers. Air-operated number selection works through cabling with a ratcheting mechanism. Pushbuttons on a remote control cabinet set the marking head, adjust for slab thickness, and actuate the marking cylinder.
PANNIER CORP., PITTSBURGH, PA.

THICKNESS MEASUREMENTS are made by pneumatic-hydraulic servo system. Fluid power amplifier is jet-pipe servo valve. Feedback element is linear transformer. Equipment is accurate to .0005 in.
GPE CONTROLS, CHICAGO, ILL.

More Briefs on page 36

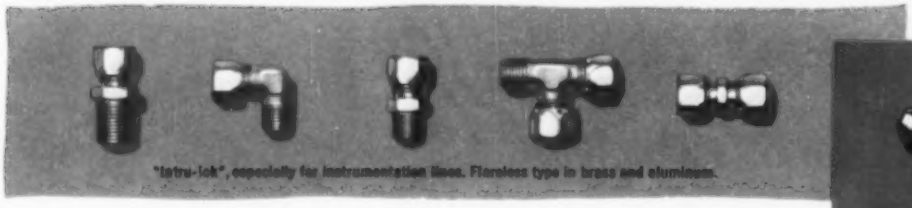
CIRCLE 70 →

PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

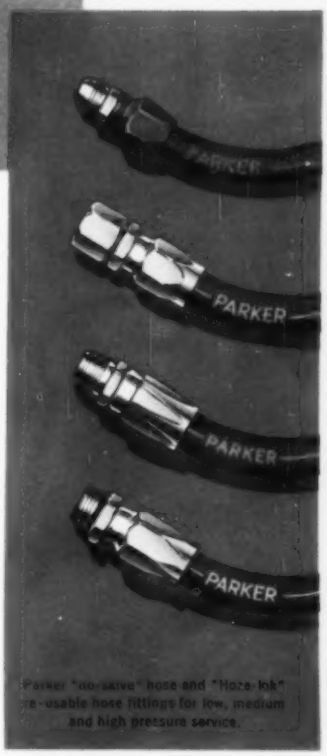
"Triple-lok", the "industrial standard"... in brass, stainless steel, aluminum, and cadmium plated steel. For flared tubing.

"Ferulok"®, the flareless type with the visible "bite", especially for heavy-wall tubing... in steel and stainless steel.

"Weld-lok" socket-type fittings, steel or stainless steel. Also "Braze-lok", in almost any metal.



"Intru-lok", especially for instrumentation lines. Flareless type in brass and aluminum.



Parker "no-skive" hose and "Hoze-lok" re-usable hose fittings for low, medium and high pressure service.

Only from Parker

such a wide range of fittings...so fast

If it's an industrial fitting, whether for tubing or for hose, Parker has it or can make it, in standard sizes in any metal.

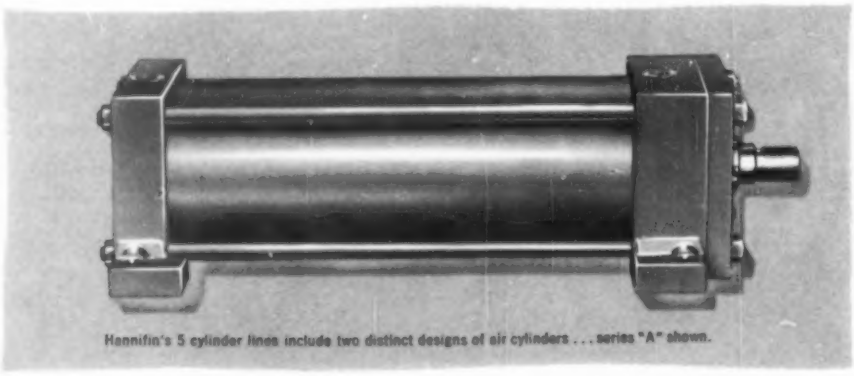
Parker "Triple-lok" for flared tubing . . . Parker "Ferulok"® for heavy-wall tubing . . . Parker "Weld-lok" for high-temperature, high pressure lines. ("Braze-lok", our newest line, does not require an open torch, is for medium temperatures.) "Intru-lok", for copper, aluminum or plastic instrumentation lines, requires no flaring. Parker hose and "Hoze-lok" re-usable hose fittings require no skiving of the hose.

There's a Parker distributor near you, write us for his name . . . call him for Parker catalogs.

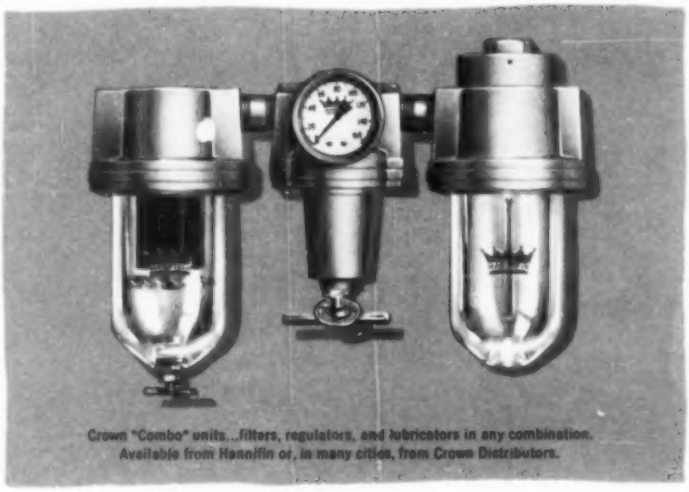
Parker Fittings and Hose Division
17325 Euclid Avenue • Cleveland 12, Ohio

A DIVISION OF PARKER-HANNIFIN CORPORATION

PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

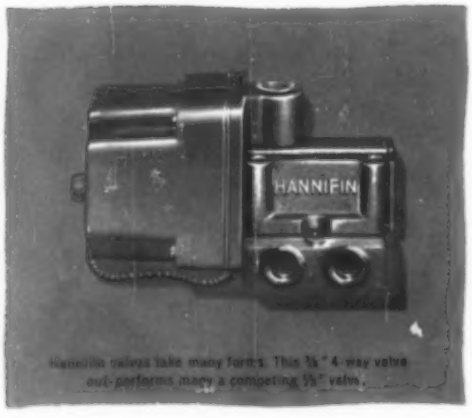


Hannifin's 5 cylinder lines include two distinct designs of air cylinders . . . series "A" shown.



Crown "Combo" units...filters, regulators, and lubricators in any combination. Available from Hannifin or, in many cities, from Crown Distributors.

Only **HANNIFIN** makes all these **AIR POWER COMPONENTS**



Hannifin valves take many forms. This ⅜" 4-way valve out-performs many a competing ½" valve.

Anywhere you use compressed air to do work, Hannifin can help you. Hannifin cylinders for the "muscles". . . Hannifin air valves for any type of actuation, hand, foot, cam, solenoid, or pressure . . . the Hannifin "Crown" Line of filters, regulators, and lubricators for lasting air power efficiency . . . all are built by Hannifin to just one standard, the best.

Turn to Hannifin, too, for expert help in applying air power components. A Hannifin field engineer is as close to you as your telephone, wherever you are. Write us for his address—or, he's listed in the alphabetical section of Thomas Register. It's that easy.

HANNIFIN COMPANY

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A DIVISION OF PARKER-HANNIFIN CORPORATION

from this combination...

the best fluid power system for your mobile equipment

The mobile-equipment specialist from Parker-Hannifin serving your territory has a head-full of practical ideas to help you use Parker hydraulic control valves, Parker permanent-end (clinch-on) hose assemblies, and Hannifin hydraulic cylinders most effectively on every type of mobile equipment.

He can help you develop hydraulic control and power circuit configurations, and select with you the best Parker units to control, transmit, and transform fluid power into motion. Write to D. A. Cameron, Parker-Hannifin Corporation, 17325 Euclid Avenue, Cleveland 12, Ohio. He'll have one of our mobile equipment engineers call at your convenience.

call in your

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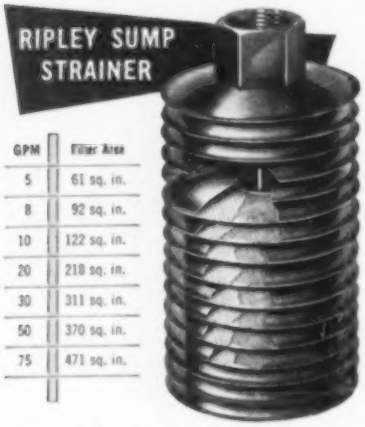
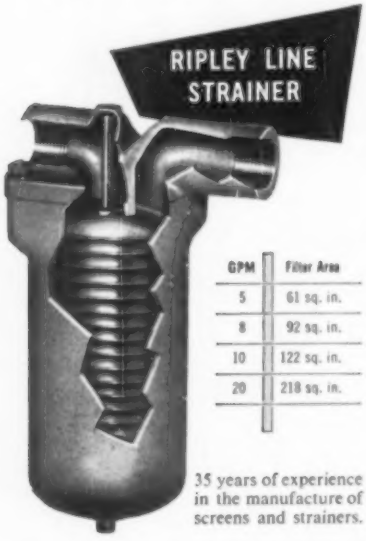
New Disc Design

GIVES YOU GREATER FILTERING AREA!



GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.
30	311 sq. in.
50	370 sq. in.
75	471 sq. in.

You'll find Ripley Strainers provide long, low-cost, trouble-free protection for your hydraulic equipment. Their self-cleansing discs have no crevices to clog or reduce flow—are assembled in standard combinations to give you *maximum* filtering area in *any* rated size! Available in sump and line models to meet your exact requirements. Send for complete information today!



GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.

35 years of experience in the manufacture of screens and strainers.

Ripley MANUFACTURING CO.
Filter Division
32749 Northwestern Highway • Farmington, Michigan

Filter Division
RIPLEY MANUFACTURING CO.
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Gentlemen: Please send me complete information on your new disc type Sump and Line Strainers.
☐ Name of nearest stocking distributor.

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CIRCLE 83 ON TIME-SAVER CARD

BRIEFS

GM Engineers Propose Changes in JIC Hydraulic Standards

Latest approved JIC hydraulic standards are dated January 1953. Today, revisions suggested by General Motors master mechanics and plant engineers are under discussion. Final approval is expected at a meeting early in 1959. Briefly, here are the major suggested revisions.

• **Diagrams**—Standards will show pictorial, cutaway and combination drawings as well as graphical diagrams for circuits. Purchaser can request any of these drawings to be furnished with the machine. And added to the list of things to be put on a drawing will be the quantity, capacity and type of suction strainer.

• **Pumps**—Providing a data sheet which will give rpm, pressure range, delivery, horsepower required, and viscosity range is recommended for inclusion in the standards.

• **Tubing**—Welded steel tubing will be acceptable along with seamless steel for fluid lines. A specification sheet has been prepared for the standards to cover electric resistance welded low carbon steel pressure tubing with outside diameter ⅜ to 2½ inches.

This table of tubing sizes and pressure ranges is new:

Operating pressure (0 to 1200 psi)

Dia. (in.)	Wall (in.)
¼	.035
⅜	.058
½	.072
⅝	.083
¾	.095
1	.109
1¼	.120

Operating pressure (1200 to 3000 psi)

¼	.049
⅜	.065
½	.083

(Welded flange fittings recommended for ⅝" and up.)

⅝	.095
¾	.120
1	.156
1¼	.188

Operating pressure (3000 to 5000 psi) (Welded flange fittings recommended.)

¼	.065
⅜	.109
½	.134
⅝	.156
¾	.188
1	.250
1¼	.313

Operating pressure (above 5000 psi)

Welded flange fittings are recommended
Wall thicknesses to be determined for the pressure specified

Well defined recommendations for supporting tubing are given in this new table:

Tube O.D.	Tube length between supports
¼ in.	3 ft.
⅜	3
½	3
⅝	4
¾	4
1	5
1¼	7

• **Reservoirs**—Maximum heat dissipation calls for reservoir design so that return oil will have peripheral flow along reservoir side wall. Magnets will be assembled to support bars and located between the return side of reservoir and suction strainers.

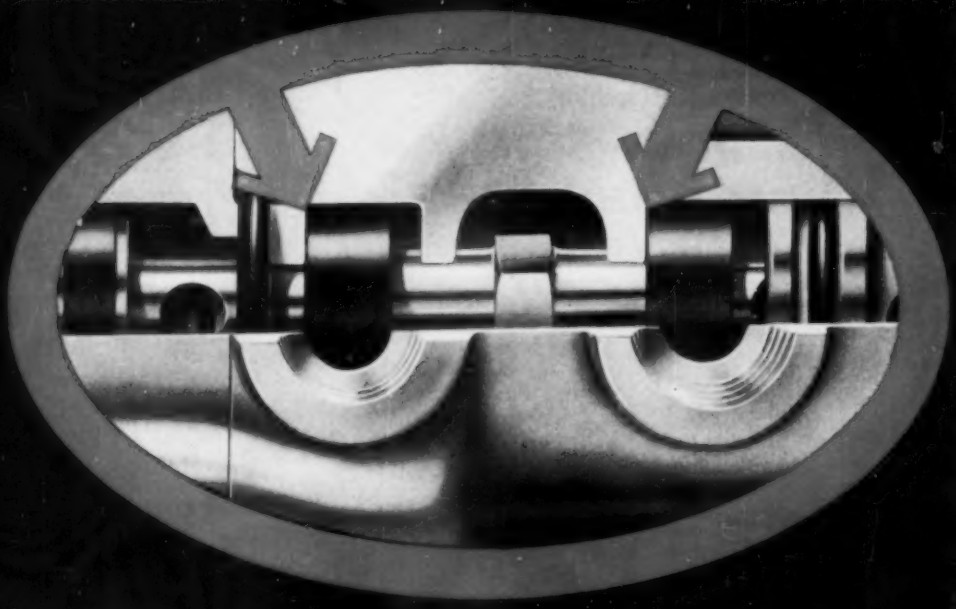
• **Valves**—A new provision will call for internal leakage to be drained to reservoir or vented manifold to prevent blocking of plunger type controls.

• **Accumulators**—Added to the information wanted on accumulator nameplate is the fluid used and fluid capacity. Also proposed revisions ask for Underwriter's Lab approval to be carried on all accumulators.

• **Component Identification**—A tag mounted adjacent to, not on, the component should plainly identify the component with the same identification shown on the diagram. This new recommendation along with the requests that valve porting be identifed adjacent to ports and all solenoids be identified are aimed toward simplifying circuit trouble shooting.

EDITOR'S NOTE: *JIC is not an organization having formal membership. It does not hold regularly scheduled meetings. To get copies of JIC standards write: JIC P.O. Box 128, Detroit 2, Mich.*

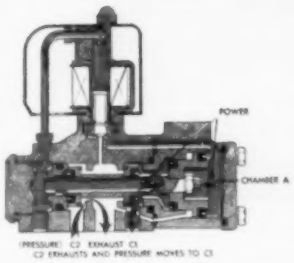
ABSOLUTELY TIGHT SEATING!



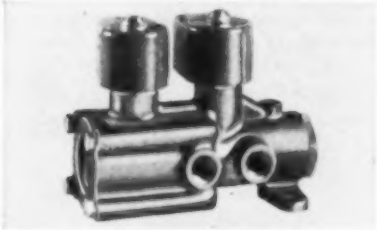
WITH ASCO POPPET TYPE 4-WAY SOLENOID VALVES

Dead tight shut-off—even on air—is assured in these four-way valves through poppet seals, and by a unique combination of metal to metal and resilient seating. No lapping, grinding or close adjustments are necessary — no binding or leaking can occur. Short piston disc assembly travel, basic design simplicity eliminate maintenance problems.

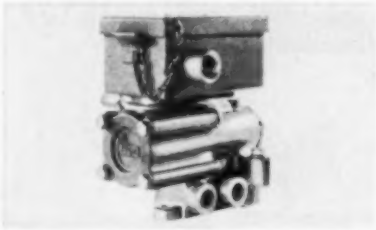
ASCO 4-way Valves are available in ⅜″ through 1″ sizes, in standard, explosion-proof or water tight enclosures. They can be mounted in any position, and permit cycling rates to 850 per minute.



Operation: ASCO Single Solenoid 4-way Valves are power-driven in both directions by line pressure. When the solenoid is de-energized, line pressure applied to the top of the piston core forces it off the seat, eliminating possible sticking due to residual magnetism. Line pressure is applied to Chamber A, moving the piston-disc assembly to the left. When the solenoid is energized, Chamber A is exhausted and line pressure drives the piston to the right. Single solenoid type (illustrated) operates when solenoid is energized; returns automatically when de-energized.



Dual Solenoid (Bulletin 8344): operates when either solenoid is energized; will not return until opposite solenoid is energized (single solenoid types return when de-energized). In dual solenoid valves, solenoids may be energized continuously or momentarily.



J.I.C. Construction (Bulletin 8346) ASCO Single and Dual Solenoid Valves can be furnished to Joint Industry Conference requirements—valves are provided with subplates, vapor-proof solenoid enclosures, and manual overrides, and are electrically inoperative with the cover removed.

New! Catalog No. 202 covers the ASCO line of Solenoid Valves. Write for your copy today.

For Immediate Delivery... World's largest stock of Solenoid Valves. A complete Solenoid Valve Stock List will be sent to you with your copy of Catalog No. 202.

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CIRCLE 11 ON TIME-SAVER CARD

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UNIT-BODY

"Double-Seal"™

HIGH-PRESSURE Ball Valves

STYLE H SERIES

. . . outstanding design newly available to industry

for
- High-Pressure service
- High-Vacuum service
- Handling of hazardous fluids
- Cryogenic operations

. . . no other valve has these outstanding features

- Unit-body construction
- Positively leakproof
- Full-flow capacity
- Indestructible in service
- Corrosion-resistant
- Contamination-proof
- Incomparable size-rating-test-burst performance ratio

—a newly developed and advanced valve design with broad industrial applications, available in eight sizes through 2", with 303 and 316 Stainless Steel or Carbon Steel bodies. Choice of nylon or "Teflon" seats and seals.

Distributors in principal cities.

For further information, write: Data: Style "H" Series

933-B

JAMESBURY CORP., 85 NEW STREET, WORCESTER, MASS.

CIRCLE 52 ON TIME-SAVER CARD

BRIEFS

Accumulator Absorbs Shock Loads

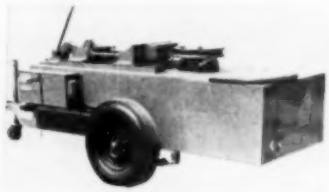
In handling 2700-lb rolls of paper with a lift truck, vehicle shock frequently caused the loads to slip and drop. This meant bent channels and distorted chains on

the truck, and irreparable damage to the paper.

To eliminate the shock an accumulator was installed in the lift circuit between the control valve and the lift cylinder. The shock was reduced to a slight floating action and droppage of paper rolls was completely eliminated. Greer Hydraulics, Inc., Jamica, N. Y., installed the accumulator at the plant of Hankins Container Corp., Union, N. J. ▼▼▼

Oil Powers Tube Bender

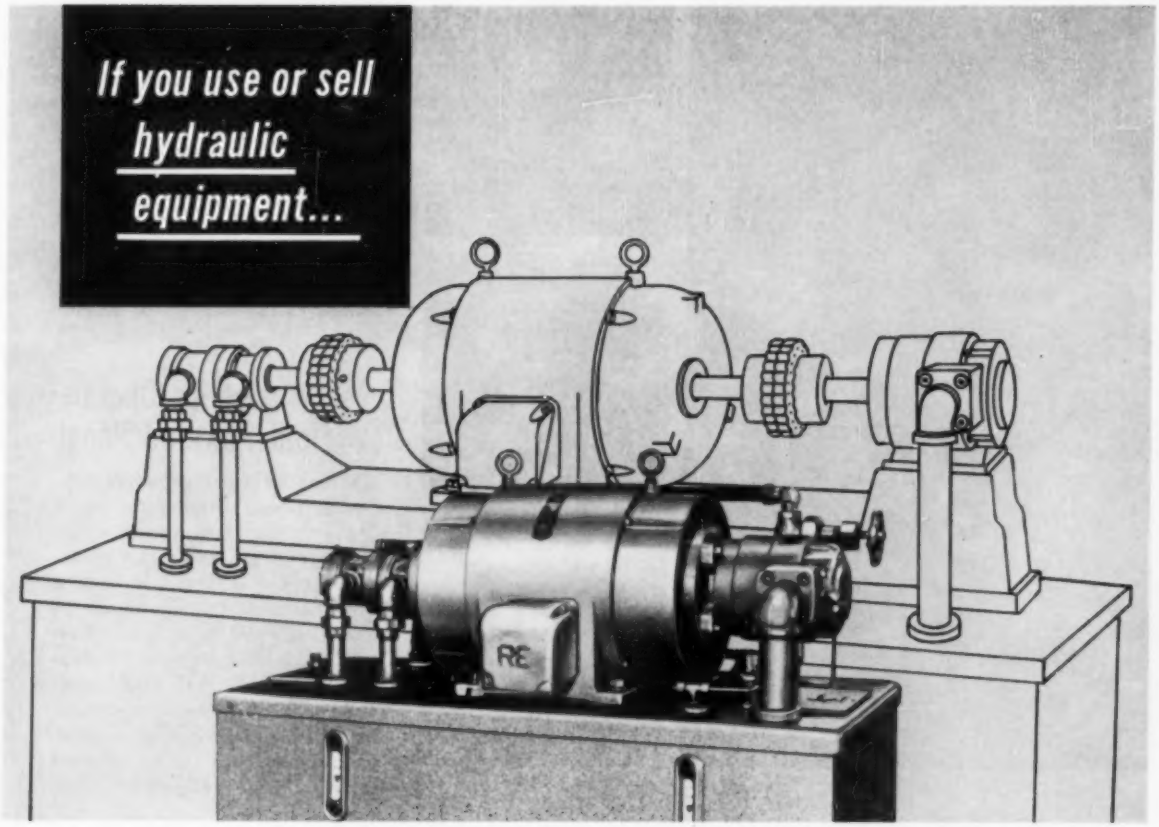
A compact hydraulic machine that bends pipe or tubing to three inches in diameter accurately at angles to 180 deg is made by Engineering Associates, Inglewood, Calif.



Both offset and reverse bends can be made and accurately repeated by setting the limit stops.

Continued on page 40

If you use or sell hydraulic equipment...



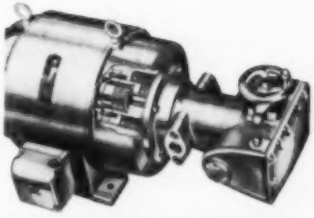
...specify REULAND spline-coupled pump mount motors

...CUT SPACE NEEDS ALMOST 50%...AVAILABLE *NOW* IN ½ H.P. THROUGH 50 H.P.!

Pump and motor become *one* with the new Reuland spline-coupled hydraulic pump hook-up. The pump shaft is connected directly to the motor's shaft *inside the motor*. Flexible couplings are eliminated... pump mount platforms are eliminated... and the tank length can be reduced because almost 50% less mounting area is required. Compact appearance is beautiful.

SPEEDY INSTALLATION

Pump-to-motor hook-up is merely a matter of seconds. All you do is slip the spline coupling onto the pump shaft...and attach the pump to the endbell. This spline coupling is supplied with the motor and is precision mated for each make of pump. There's no time wasted tinkering around...takes only a fraction of the ordinary time.



PRECISION ALIGNMENT

Alignment is perfect *automatically* whether the installation is made out in the field or on the production line. This permits even unskilled workmen to handle this simple task without error. Also, by hooking the pump up at the point of bearing support, within the motor, vibration is reduced to a new minimum. Operation is smooth, quiet.

COSTS LESS...SAVES INSTALLATION LABOR... FITS ALL PUMPS...FILLS ALL POWER NEEDS—

½-50 H.P. The Reuland spline-coupled unit is priced lower than a conventional set-up ...saves you extra money by reducing installation costs. What's more, we can supply it to fit any make of pump you may be using...and to your *exact* power needs, from ½ h.p. through 50 h.p. So sure are we that it will be of help to you, we are offering to engineer a demonstration unit to your equipment, without the slightest obligation. These units are our best salesmen.

Our New General Catalog Will Come In Handy—Sent Free on Request.

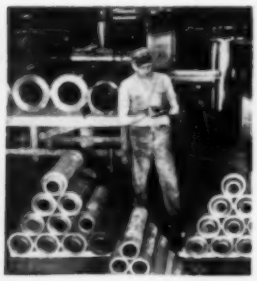
MODERN POWER FOR MODERN-DAY PRODUCTS

REULAND MOTORS

REULAND ELECTRIC COMPANY
WESTERN DIVISION: Alhambra, California
EASTERN DIVISION: Howell, Michigan
DISTRIBUTORS IN ALL PRINCIPAL CITIES

*Trademark Registered

CIRCLE 82 ON TIME-SAVER CARD



You machine better and faster with

SHENANGO CAST BAR STOCK

Because Shenango tubular stock is *centrifugally* cast, impurities and pockets are *forced* out of the metal in the molten stage. Moreover the grain is finer, pressure-dense and more uniform. This results in smoother machining, better control, and less waste of time and metal.

Made of high-strength Meehanite metal or long-lasting bronze, Shenango tubular stock comes in a *complete* range of I.D. and O.D. sizes. Its lengths go up to 20 feet, depending on diameter, which keeps cut-off waste to a minimum.

While the demand for Shenango bar stock is largely tubular . . . solid round, square, hexagonal, rectangular and other special shapes are readily available.

It will pay you to specify Shenango bar stock for longer wear, greater strength, fewer rejects . . . and lower over-all cost. For full information, write to: *The Centrifugally Cast Products Division* of The Shenango Furnace Company, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE® METAL • ALLOY IRONS

CIRCLE 88 ON TIME-SAVER CARD

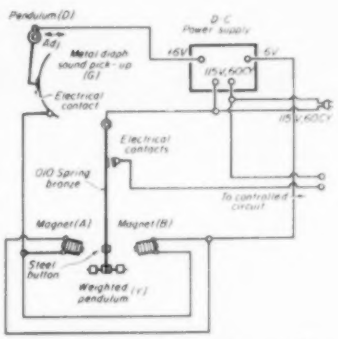
BRIEFS

Maximum distortion of cross section is less than two percent.

Hydraulic pump is driven by a 3-hp, 220/440 volt motor. All electrical equipment is weatherproofed. Unit is welded construction and weighs 2500 lbs. At maximum rating, the bending moment applied to the pipe is 160,000 in-lbs. ▼▼▼

Sounds Operate Fluid Powered Panel

Womack Machine Supply Co., Dallas, Texas, exhibited recently a new type panel of valves, cylinders, air motors and rotary actuators. It was designed in such a way that almost any sequence of operation could be attained. Feature of the display was a sound sensitive switch that would start and stop the electro-pneumatic panel by modulated voice control. The sound switch can be adjusted to operate with a clap of the hands at 50 ft.



● **How it works**—The pendulum D is adjusted until it lightly rests against the pick-up diaphragm G. Pendulum Y is moved over manually until it is held by magnet A. Both magnets are energized through the diaphragm electrical contact. Any momentary sound of sufficient magnitude to vibrate the diaphragm will open the electrical contact, breaking the magnet circuit. Pendulum Y swings away from magnet A and is attracted to magnet B. (Magnet circuit has been re-established). The electrical contacts on pendulum Y

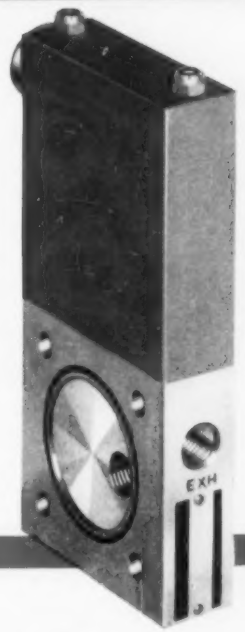
Continued on page 42

Introducing the new

HUNT

Slim Line
VALVES

SOLENOID, SINGLE PILOT
DOUBLE PILOT, LEVER
OR BALL ACTUATED



ONLY 1″ THICK BY 3″ WIDE

Compact, light in weight, and easily manifolded, these new Hunt valves have been designed specially for use when mounting space is limited. Ideally suited for controlling small cylinders, or to operate diaphragms, pilot cylinders or other devices. Pressures to 125 psi.

Proven, dependable Hunt construction, with hollow, radially ported stainless steel plunger; and "O"-ring seals accurately positioned with metal spacers, held rigidly in metal to metal end abutment. No lapped joints and no rubbing of metal against metal to cause wear, assuring long, efficient, maintenance-free operation.

Easily manifolded. The side of each valve is counterbored, trepanned for an "O"-ring and provided with four through holes. This permits up to eight valves to be manifolded together in any of four 90° angle positions, and operated simultaneously from a single supply;— or up to sixteen valves from two supply sources.

More startling HUNT designs to come!

Send for the "SLIM LINE" Bulletin No. 581 TODAY!

HUNT

Quick-As-Wink*® AIR AND HYDRAULIC CONTROL *Valves

Manufactured by HUNT VALVE COMPANY, 1992 East Pershing St., Salem, Ohio

CIRCLE 48 ON TIME-SAVER CARD

FULFLO

piston-type oil relief by-pass valves for O.E.M. or replacement

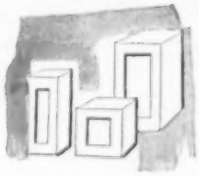
Best Buy because

QUICK DELIVERY

Fulflo stocking policy *and* practice permits quick shipment from stock of most standard types. Shipment is usually made *within 24 hours.*

TECHNICAL SERVICE

Fulflo engineers are ready *and* able to help you with any valve problem. Modified standard or special valves can be provided for any need.



WIDE RANGE OF TYPES AND SIZES

- Standard and flanged models
- Just 6 springs for pressures to 500#
- Wide range of brass, cast iron or steel bodies . . . brass, steel or stainless pistons
- Pipe sizes to 3″
- SPECIALS to your requirements

Write for "Fulflo Valves Mechanical Data Book"

FULFLO

THE FULFLO SPECIALTIES CO., INC.
415 FANCY AVENUE • BLANCHESTER, OHIO

CIRCLE 36 ON TIME-SAVER CARD

BRIEFS

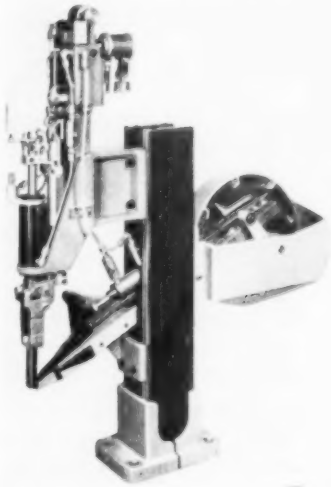
supply current to an external circuit which can be used to operate any electrical machine control.

Another momentary sound reverses the action, swinging pendulum Y to magnet A, cutting off current to the external circuit. ▼▼▼

Pneumatic Assembly Machine

Unit consists of an automatic parts positioner and a newly developed feeder which guides the parts into place. Both are air-cylinder operated. No curved tracks are used and it does not depend on gravity to place the parts in the chuck.

Built by Dixon Automatic Tool Co., Rockford, Ill., the machine will handle parts from 1/16 to 2 in. at speeds to 6000 per hr.



The feeder is powered by a double-acting air cylinder, which actuates both the feeder drum and the shuttle-type escapement. As the positioner head cycles, the cylinder rotates the drum intermittently through a pair of spring clutches.

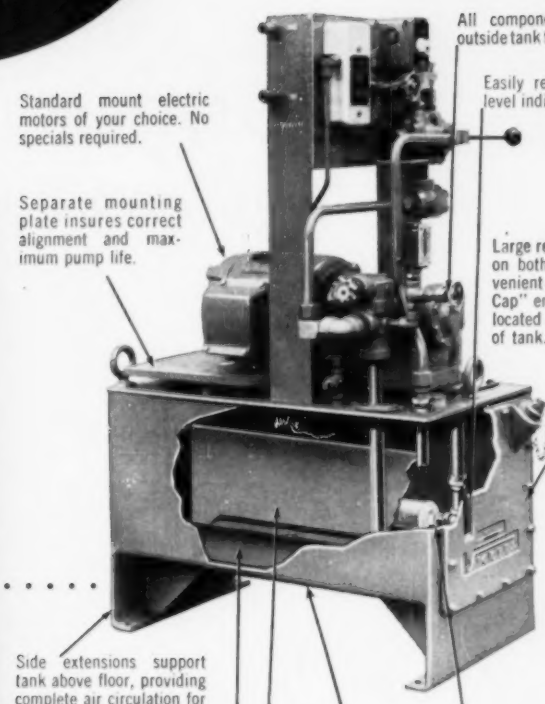
• **Sensing Device**—A feature of the positioner is the built-in sensing mechanism which stops the machine if a part is missing or

Continued on page 44

CIRCLE 102 ⟶

You save money and time applying Hydraulics when you buy the . . .

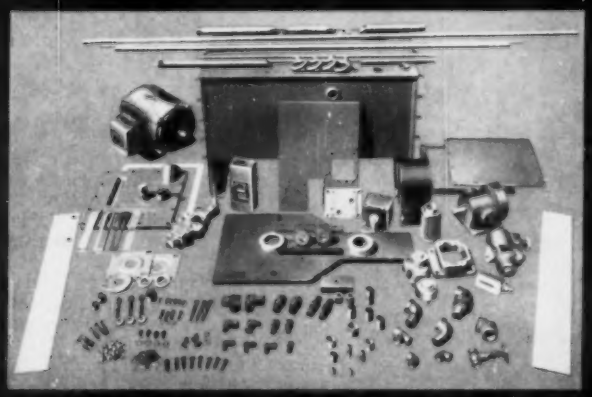
VICKERS *package . . . . . instead of parts*


All components mounted outside tank for easy access.
Easily read accurate fluid level indicator.
Standard mount electric motors of your choice. No specials required.
Separate mounting plate insures correct alignment and maximum pump life.
Large removable covers on both ends for convenient cleaning. "Filler Cap" end cover can be located at either end of tank.
Side extensions support tank above floor, providing complete air circulation for maximum heat rejection.
Corrosion protection—internal tank surfaces sandblasted and specially painted.
Inlet strainers can be removed and cleaned without disconnecting components or pressure piping.
New baffle plate improves fluid circulation.
Easy accessibility to drain plug.

Vickers Custom Built Power Package . . . complete . . . factory pretested . . . ready to connect and operate.

You save time and expense of design, layout, multiple purchasing, and assembly when you buy the Vickers package. You are assured of component compatibility and Vickers undivided responsibility and guarantee for the entire hydraulic package.

A Vickers Custom Built Hydraulic Power Package is a "complete unit" . . . factory pretested, ready for you to connect and operate. Designed and professionally built to your specifications.



These parts are required to build the Power Package shown above. Purchasing the complete package from Vickers saves you the time and cost of design, assembly, and testing. It also assures the most suitable unit for your particular requirements.

Call in a Vickers Application Engineer or write for Bulletin 5001B.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO* • CINCINNATI • CLEVELAND • DETROIT* • GRAND RAPIDS • HOUSTON • INDIANAPOLIS • LOS ANGELES AREA (El Segundo)* • MILWAUKEE • MINNEAPOLIS • NEW YORK AREA (Springfield, N.J.)* • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE* • ST. LOUIS • TULSA • WORCESTER • Factories also in: Australia, England, Japan and Germany • In Canada: Vickers-Sperry of Canada, Ltd., Toronto,* Montreal and Vancouver
Field Service Headquarters Underlined. Whse. Stock & Repair Branches*.

8155

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CYLINDER TUBING . . .

"mirror-finished" by Standard

Standard "mirror-finished" cylinder tubing is full-finished to use without further sizing or finishing for such applications as *automobile shock absorbers, power steering* and *hydraulic pumps.* When it comes to punishment, it can really take it. Every inch of this rugged tubing measures up to exacting specifications in cylinder finish . . . in ID tolerances as close as .001" . . . in extreme uniformity of wall thickness and concentricity . . . in internal pressure resistance, *tested to shocks up to 9000 p.s.i.* Cylinder sizes to 3½" OD x .187" wall. For full information on Standard's complete range of products, plant facilities and engineering assistance send for *free* folder below.

- Welded Stainless Tubing and Pipe.
- Welded Carbon Steel mechanical.
- Boiler and Heat Exchanger.
- Exclusive rigidized pattern.
- Special Shapes.

Free 8-page folder on all Standard products. Write to address below.

Shock absorber with metal-to-metal plunger in cylinder tube held to .001" ID tolerance. "Mirror-finish," concentricity and precision tolerance makes Standard cylinder-grade tubing usable *as is* for hydraulic and other cylinders.

STANDARD

THE STANDARD TUBE COMPANY and MICHIGAN STEEL TUBE PRODUCTS DIVISION

24400 Plymouth Rd. • Detroit 39, Mich.

Welded stainless tubing and pipe • Welded carbon steel mechanical Boiler and Heat Exchanger • Exclusive rigidized patterns • Special Shapes • Steel Tubing—Sizes: ½" OD to 6" OD—.028 to .270 wall Stainless—Sizes: ¼" OD to 3¾" OD—.020 to .187 wall.

CIRCLE 91 ON TIME-SAVER CARD

BRIEFS

malformed. The machine stops with the ram in the forward position, making it easy to locate the trouble. A wrong or misplaced part limits piston travel and prevents opening the poppet valve for the return stroke. Flow control valves adjust the speed of cycling. ▼▼▼

Beat the Heat With FR Fluid

A large steel mill relies on a fast-moving heat-resistant tractor-shovel to bank the doors of its seven open hearth furnaces with dolomite. With furnace temperatures to 3000 F, the banking must be rapid to protect men and equipment from heat.

The shovel is made of heat resisting steel and the fuel tank is mounted in the rear away from the

heat. Hydraulic controls make it fast acting. Torque converter and power-shift transmission mean no foot-clutching is necessary to change speed or direction.

Heat from the furnace caused mineral oil base hydraulic fluid to bubble and foam. Bucket tilt and arms worked sluggishly.

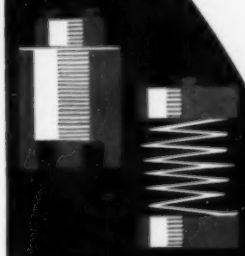
The hydraulic system was filled with a fire-resistant fluid that works at 450 F. The sluggishness ended. While banking the furnace, temperature of the tractor-shovel will rise a couple hundred degrees, but has no affect on the FR hydraulic fluid.

The shovel, made by Clark Equipment Co., also lifts and positions a 5 x 7-ft, ¾-in. steel plate across the door of each furnace before charging. ▼▼▼

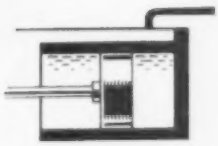
RACINE-SECO

now offers for your hydraulic circuits

MECHANICAL



ELECTRIC

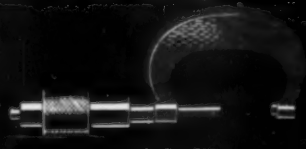


HYDRAULIC OR PNEUMATIC

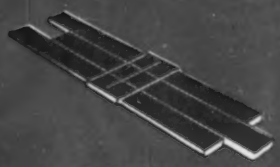
ELECTRONIC

the controls of your choice . . .

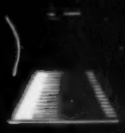
for the results you want



ACCURACY



FLEXIBILITY



RELIABILITY

SIMPLICITY

The method of pump control you choose determines the final results of your hydraulic circuit. RACINE - SECO makes available a complete range of controls for all requirements.

Let a RACINE - SECO representative help you select the right method of control for your operation. From a simple mechanical control to the most comprehensive electronic feed-back system, a RACINE - SECO engineered circuit will give you the results you want.

RACINE SECO

RACINE HYDRAULICS & MACHINERY, INC.

2074 ALBERT STREET, RACINE, WISCONSIN

PUROLATOR FILTERS FOR THE PROTECTION OF HYDRAULIC CIRCUITS

G-200M Aircraft Restrictor Filter two-way for hydraulic oil systems metal element

PR 301 ½ GPM line type hydraulic oil filter Micronic element

PR 362 3 CFM in-line vent type Micronic element

G 200 series in-line two-way restrictor filter Metal element, internal connections

PR 312 12 GPM line type filter Micronic element

PR 412-8 12 GPM line type filter Military approval

G-187 3 GPM in-line hydraulic oil filter Metal element

P 32-28 Low pressure, high flow hydraulic oil filter

Effective filtration is essential for optimum performance in hydraulic circuits. To keep a system clean and functioning properly, it is important that the filter be designed specifically to meet the requirements of the job.

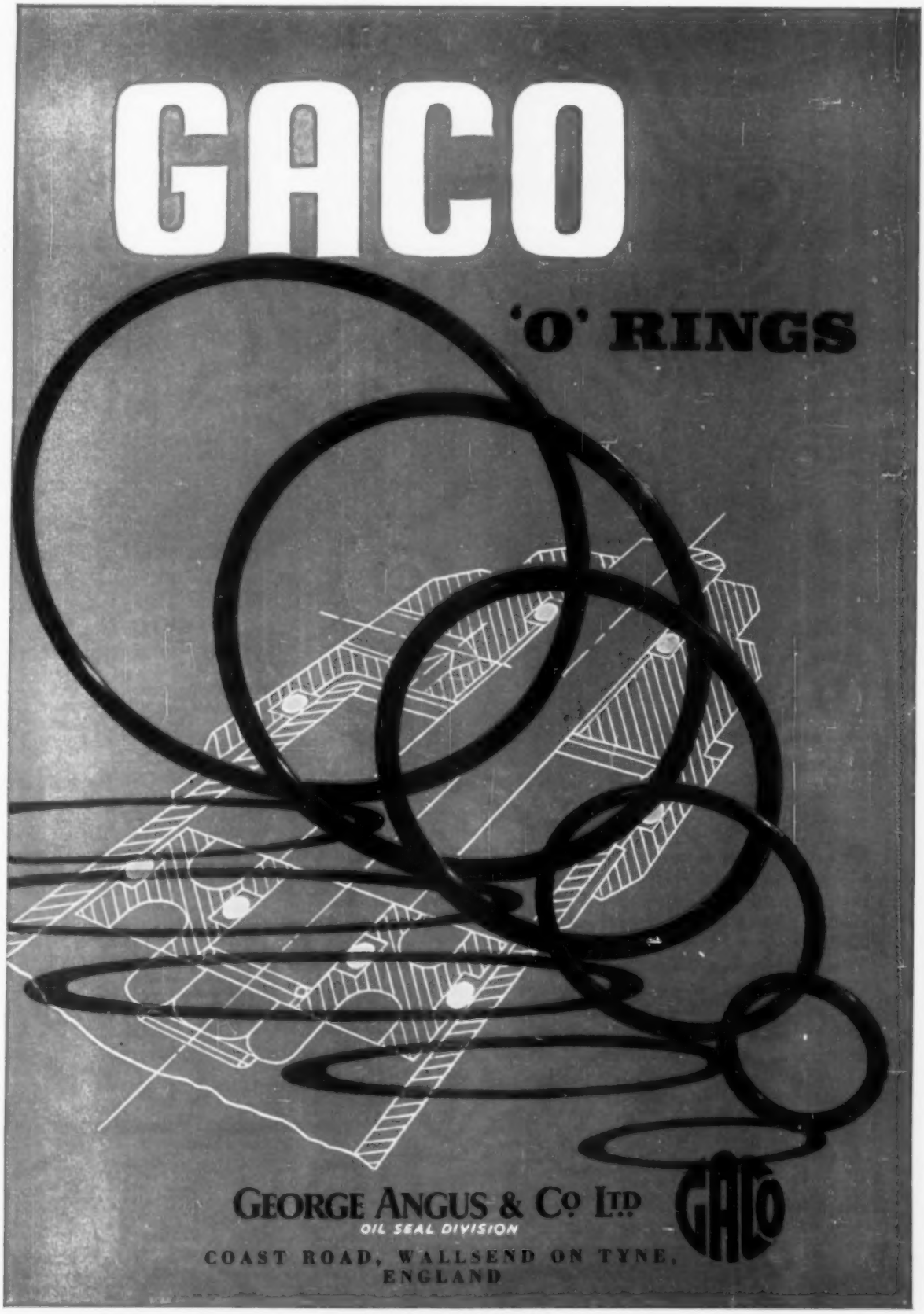
Purolator's complete line of filters for hydraulic systems includes models for every set of operating conditions likely to be encountered. A few are shown here; there are many more standard models from which to choose. If your application requires a special filter, Purolator will design and build it. Let Purolator work on your toughest filtration problem.

Filtration For Every Known Fluid

PUROLATOR PRODUCTS, INC.

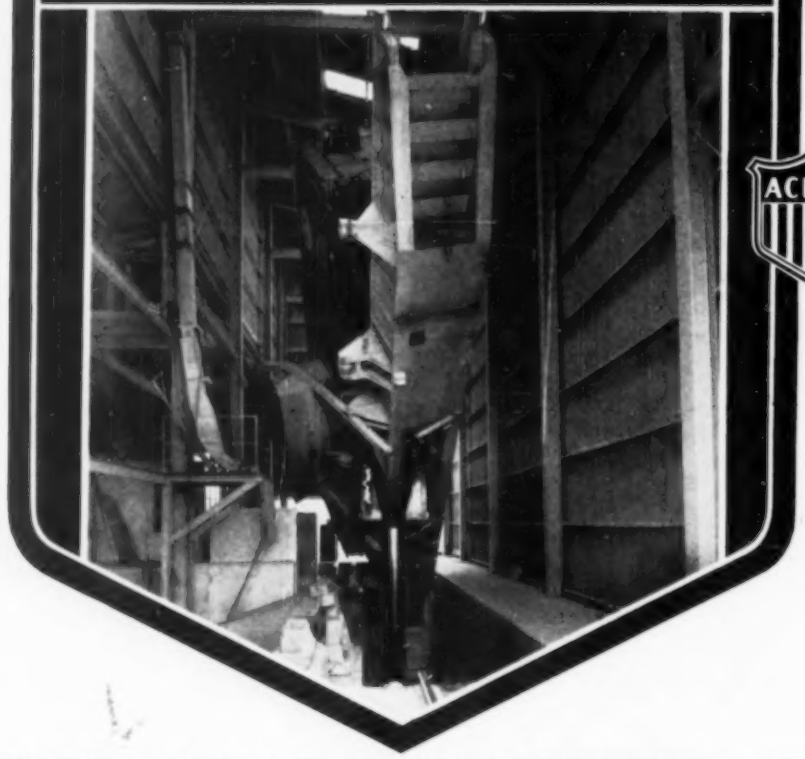
Rahway, New Jersey and Toronto, Ontario, Canada

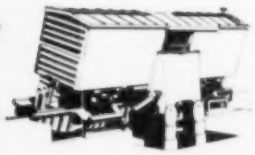
CIRCLE 78 ON TIME-SAVER CARD

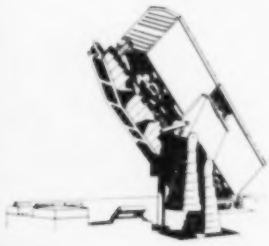


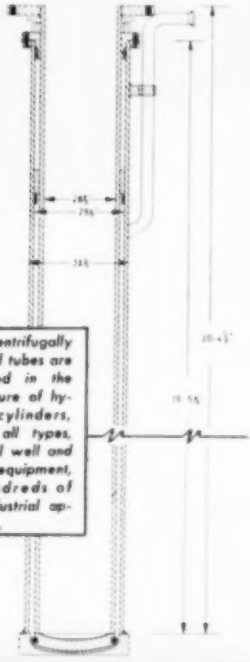
CIRCLE 8 ON TIME-SAVER CARD

ACIPCO TUBES SUPPLY "*muscle*" IN NEW GRAIN UNLOADER









This bulk box car unloader, the "Sequencomatic" by Straight Engineering Company, is an outstanding example of efficient and ingenious design. It literally picks up a loaded car weighing up to 220,000 pounds holding as much as 2200 bushels of grain and pours out its contents, smoothly and completely, in as little as *just four minutes.*

The massive "muscle" of this superior grain unloader is a hydraulic cylinder almost twenty feet long. Acipco supplied this cylinder, *completely fabricated.* It is an example of the ability of Acipco's complete facilities to meet rigid specifications promptly and dependably. This cylinder is also an example of the unsurpassed *quality* offered in Acipco centrifugally spun steel tubes.

Investigate the outstanding potentials of Acipco tubes for service in your tubular application. You, too, will find extra quality at extra savings.

Acipco centrifugally spun steel tubes are now used in the manufacture of hydraulic cylinders, rolls of all types, drums, oil well and chemical equipment, and hundreds of other industrial applications.

SIZE RANGE: Lengths up to 16' — longer lengths by welding tubes together. OD's from 2.25" to 50" , wall thicknesses from .25" to 4".

ANALYSES: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steels, plain carbon grades and special non-standard analyses.

FURNISHED: As cast, rough machined, or finish machined, including honing.

AMERICAN CAST IRON PIPE CO.
Special Products Division
BIRMINGHAM 2, ALABAMA

DISTRIBUTORS

Austin-Hastings Co., Inc.
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Cambridge 42, Mass.

Peter A. Frasse and Co., Inc.
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New York 13, N. Y.

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CIRCLE 5 ON TIME-SAVER CARD

AT A FAMOUS ORDNANCE PLANT IN NORTHERN LOUISIANA:

600-Ton Lubrication Job for Cities Service!

The huge 600-ton press above is one of several at a well known Louisiana ordnance plant operated by the Remington Rand Division of Sperry Rand Corporation.

A big machine, it naturally poses a big lubrication job... but not so big that Cities Service Pacemaker Oil can't take it in stride. With unusually high viscosity index and superior fortification against oxidation, corrosion and rust, Pacemaker is a natural for the task.

Likewise, throughout the various stages of producing artillery shells—the end product—Cities Service lubricants are hard at work.

Clearly, there's little room for error here—either in the product itself or in the machines that make it. That's why Cities Service lubricants were chosen... and it's an equally good reason for making them *your* choice.

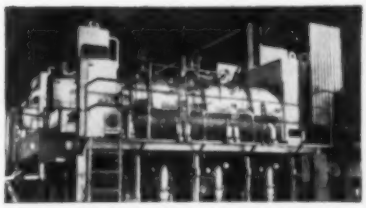
For a survey of your plant's lubrication needs, talk with a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

HOW THE ORDNANCE PLANT USES CITIES SERVICE LUBRICANTS

MACHINE	LUBRICANT
Large presses	Pacemaker 3 Hydraulic Oil
Airlines	Pacemaker 1
Speed reduction units	Pacemaker 6
Worm gear reduction units	Optimus 6
Package compressor units	Pacemaker 5
Metal working machines requiring a water soluble cutting oil	Chillo A
General Lubrication	Trojan Gear Oils, Trojan H-2 Grease

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



High Speed Gas Furnace heats steel to 2660 degrees F. All lubrication is supplied by Cities Service products.

Partially Finished Shells await final forming. Unusual number of forming operations are required to produce final product.

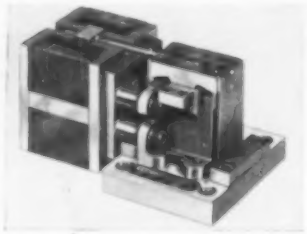
Forming Press does final forming of artillery shells. The press is lubricated by Cities Service Pacemaker Hydraulic Oil.

CIRCLE 22 ON TIME-SAVER CARD

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

ELECTROHYDRAULIC SERVO VALVE . . . has only two moving parts



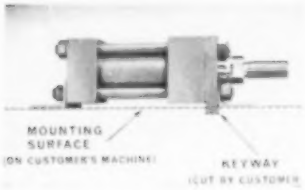
Features: No metal-to-metal contact between sliding plate and valve body. Frictionless for high sensitivity and fast response. No sticking, scoring, or jamming. Clearances can be varied to suit application and fluid. Hardened stainless steel construction. Life of over 100-million cycles. Valve centers if power is interrupted for fail-safe feature.

Specifications: Flow 4 gpm at 250 psi, 8 gpm at 1000 psi drop across the valve. Supply pressures to 3000 psi. Power demand 5 watts max. Stroke ±0.015 in. Differential current 150 ma. Resistance per coil 80 ohms. Weight 4¼ lbs.

The Oilgear Co.
Milwaukee, Wis.

CIRCLE 300 ON TIME-SAVER CARD

AIR AND OIL CYLINDERS . . . have shear key mounting



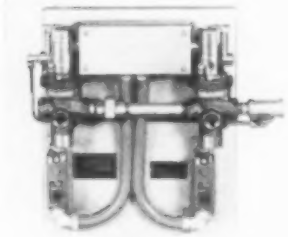
Designation: P Modification

Features: Standard for all surface-mounted square cylinders. Gives quick, positive alignment of the cylinder in a keyway milled into the mounting surface. Most of the thrust is taken by the key instead of the mounting bolts, which is desirable where maximum pressures and short strokes are used. For both air and hydraulic cylinders. Key thickness machined to close tolerance for accurate fit.

Hannifin Co.
Division of Parker-Hannifin Corp.
Des Plaines, Ill.

CIRCLE 301 ON TIME-SAVER CARD

AIR CONTROL SYSTEM . . . has anti-repeat feature



Designation: Andrus-Coon Press Control

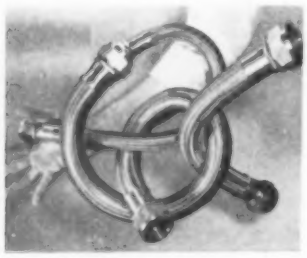
Features: Has two separate electrical, pneumatic and mechanical control circuits, operating in tandem. These are completely interlocked so that failure of any one, or more than one, control component automatically stops the machine at once, or at end of cycle. It also prevents start of next cycle until fault is corrected.

Operation: Two poppet-type air valves, two anti-repeat relays, two valve relays and two sets of limit switches are monitored at the end of each cycle. Air valve operation is sensed by external limit switches, actuated by valve stem extensions. If any control unit fails to complete its cycle, the monitoring circuits prevent start of next cycle.

Textrol, Inc.
Cleveland, Ohio

CIRCLE 302 ON TIME-SAVER CARD

TEFLON HOSE . . . is "finger-flexible"



Designation: Springfield 400

Features: Inner tube design gives excellent flow characteristics. Minimum bend radius is 3 1/3 times the equivalent tube size. Hose is helically wound on a mandrel and overlaid by Teflon-coated fiberglas tape. A die compresses the two together. Stainless steel wire is then braided over the hose. Compression fittings are swaged onto the hose at the factory.

Specifications: Made in sizes ¾ to 2 in. for temperatures from —65 to 400 F. When bent below the minimum bend radius, hose will flatten out, but return to its original shape with no damage when straightened out.

Titeflex, Inc.
Springfield, Mass.

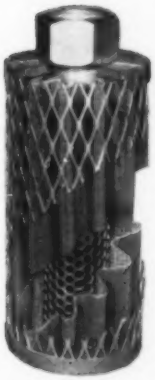
CIRCLE 303 ON TIME-SAVER CARD

Continued on page 52

MARVEL Synclinal FILTERS

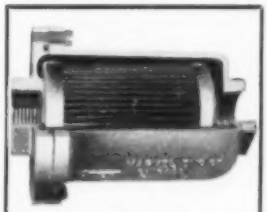
are Standard Equipment!

Illustrated below are a few but a representative group of heavy Construction and Road Building equipment on which the manufacturers install Marvel Synclinal Filters as standard equipment.



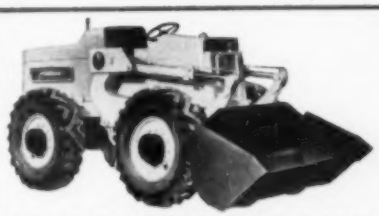
SUMP TYPE
(Cutaway)

LINE TYPE
(Cutaway)

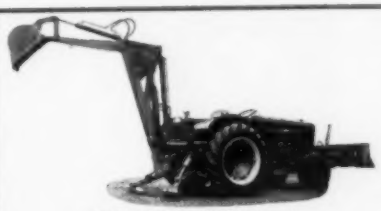


IN-LINE FILTER

Handles up to 25 G.P.M. of hydraulic oil at very low pressure drop. Monel wire cloth filtering media in mesh sizes from 30 to 200. Cartridge is easily removed for cleaning.



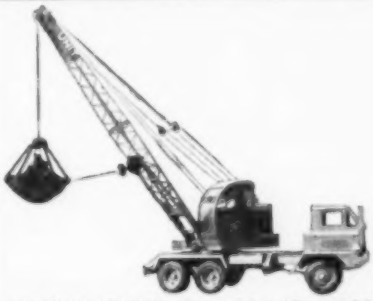
"PAYLOADER" TRACTOR-SHOVEL Model HH
The Frank G. Hough Co. Libertyville, Ill.



PIPPIN EXCAVATOR and ANGLING BULLDOZER
Pippin Construction Equip. Inc. White River Junct. Vt.

FRONT END LOADER
Ottawa Steel Products Ottawa, Kans.

25 TON DART TRUCK Model 25 SL
Dart Truck Company Kansas City, Mo.



UNIT CHALLENGER ⅜ YARD EXCAVATOR
Unit Crane & Shovel Corp. Milwaukee, Wis.

22 TON EUCLID TRUCK Model TD
Euclid Road Machinery Co. Cleveland, Ohio

Manufacturers of equipment utilizing Hydraulic or other low pressure circulating systems install Marvel Synclinal Filters as Standard Equipment.

OVER 800

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation as described in catalog. Choice of Monel mesh sizes range from coarse 30 to fine 200.

MEET JIC STANDARDS

EASY TO CLEAN

Both sump and line types may be easily disassembled, cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Catalogs containing complete data available on request

IMMEDIATE DELIVERY!

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated (AH-12)

- ☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name ..... Title .....
Company .....
Address .....
City ..... State .....

will it fit our circuit?
who makes it?
what size does it come in?
where can I buy it?

Better check the
Fluid Power
DIRECTORY

More than 65,000 engineers (in over 9,000 plants) keep the Fluid Power Directory handy. It's their quick reference to the hundred and one questions that pop up during a hydraulic or pneumatic circuit design. Specifically they check the Fluid Power Directory for:

- ***CATALOG DATA*—condensed specs on more than 150 manufacturers' products.**
- ***TRADE NAMES*—cross referenced to makers.**
- ***DIRECTORY*—who makes what for hydraulic and pneumatic systems: over 150 product groups, more than 800 manufacturers listed for easy reference.**
- ***DESIGN MANUAL*—circuits, nomographs, designs and applications: a complete handbook for industrial, mobile and aviation systems.**
- ***LOCAL SOURCES*— an index to local outlets for speedy supplier selection.**

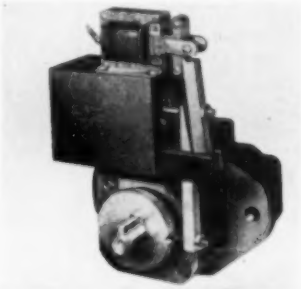
***Now in preparation:* the 1960/61 Fluid Power Directory**
***Publication date:* October 28, 1959**
***Closing date for advertising:* July 24, 1959**

compiled by the editors of
APPLIED **Hydraulics & Pneumatics**
an Industrial Publishing Corporation magazine
812 Huron Rd. • Cleveland 15, Ohio

NEW PRODUCTS

ONE REVOLUTION DRIVE . . . is fluid powered

Features: Gives smooth, quiet, instant high torque through fluid motor, planetary reduction and solenoid starter. Cam and adjustable finger lever provide rapid, smooth



acceleration and deceleration and positive stop. May be made for manual or mechanical starting, or multi-revolution operation.

Applications: An accurate drive for indexing, feeders, turntables, packaging machinery, and office equipment.

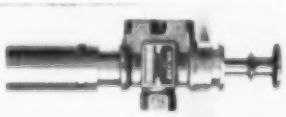
Specifications: Made in a wide range of output torque capacities and speeds. Size, 6 in. long x 5 in. wide x 7 in. high.

John S. Barnes Corp.
Rockford, Ill.

CIRCLE 304 ON TIME-SAVER CARD

KNOB-CONTROLLED VALVES . . . for panel mounting

Features: For air or hydraulic pressures to 200 psi. Fast push-type action for emergency control applications. Can be mounted on panels from ⅜ to 1⅛ in. thick. Spacers are used to mount valves in panels of less than maximum thickness.

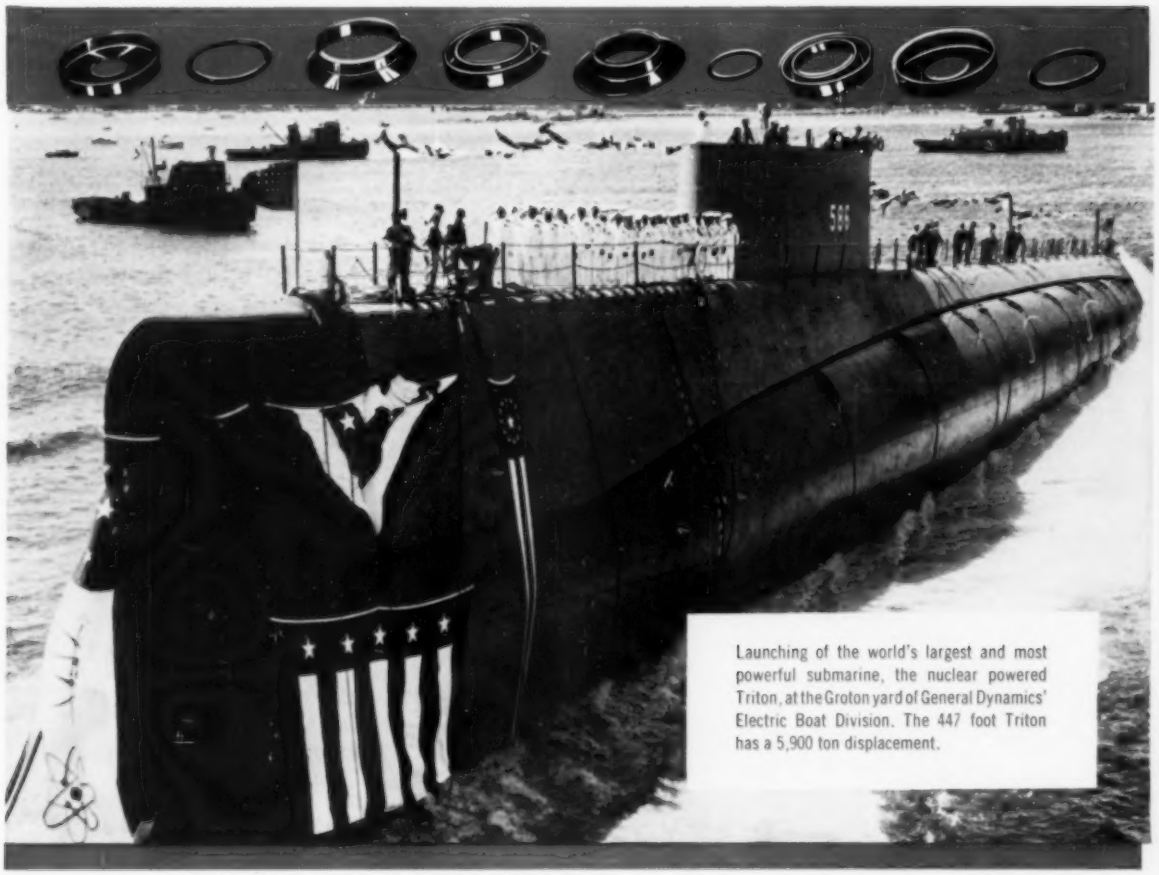


Specifications: Made in ¼ to ¾ in. NPT, 3 and 4 way types. One piece Navy M bronze bodies. Valves for hydraulic service have heat-resistant O-ring packing. Air valves have Hycar OU packing for resistance to water and oil.

Valvair Corp.
Akron, Ohio

CIRCLE 305 ON TIME-SAVER CARD

Continued on page 54



Launching of the world's largest and most powerful submarine, the nuclear powered Triton, at the Groton yard of General Dynamics' Electric Boat Division. The 447 foot Triton has a 5,900 ton displacement.

Hundreds of HOUGHTON PACKINGS are at work here!

RADAR PICKET SUB TRITON, like her nuclear powered sisters*, has long-term performance built into her many hydraulic circuits by dependable packings by Houghton.

In wide use aboard Triton are VIX-SYN synthetic rubber packings, and when interest in fire-resistant fluids necessitated some shifts to compatible packings, VIM leather units impregnated with a liquid rubber polymer were recommended.

But this change involved no engineering changes or revamping of existing drawings. The stack heights of all types of Houghton "V" packings are identical. Through standardization of stack lengths, rubber can be easily replaced by fabricated or leather packings, or materials can be used interchangeably with one set.

From Houghton's long experience with packings and compatible fluids, you always get the maximum from your hydraulic systems. You get the flexibility of a complete line and the economies of one-source supply, plus the many benefits of Houghton technical service.

Call or write today, to E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Penna., for "Packings by Houghton" descriptive folder.

PACKINGS and HYDRAULIC FLUIDS

* Nautilus
Skate
Seawolf
Skipjack

... products of

E. F. HOUGHTON & CO.
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

Ready to give you on-the-job service

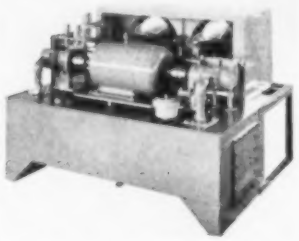
CIRCLE 47 ON TIME-SAVER CARD

NEW PRODUCTS

HYDRAULIC POWER UNIT
. . . is air cooled

Features: Fans are interlocked to run when the electric motor operates the hydraulic pump. Thermostatic controls maintain constant temperature.

Specifications: Two double-vane pumps are coupled to a 7½-hp double-end shaft motor. Each of the four pumps has separate pressure



controls. Two 11-gpm pumps are used for servo-controlled tracers. An 11-gpm and a 3-gpm pump are for clamp and position cylinders. All connections are brought to one corner of the unit to simplify piping.

J. N. Fauver Co. Inc.
Detroit, Mich.

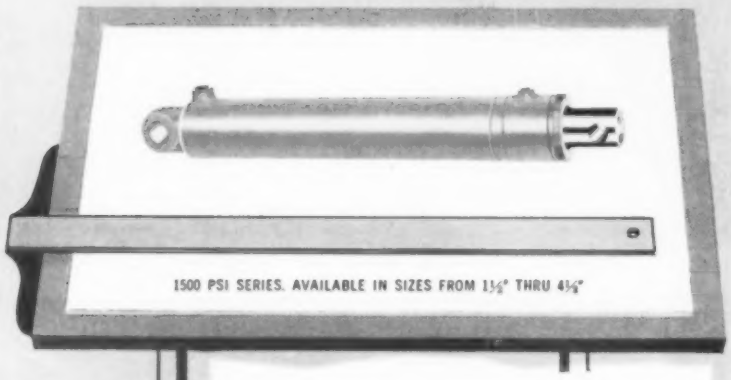
CIRCLE 306 ON TIME-SAVER CARD

BH EW

SINGLE ACTING GENERAL PURPOSE

Hydraulic Cylinders

PISTON STYLE



BHEW's SINGLE ACTING GENERAL PURPOSE CYLINDERS, designed around standard components, are the basic elements of custom cylinders. Flexibility in standard parts means BHEW can supply a cylinder to fit almost any application. Available in a variety of mountings (pin eye is standard), with adjustable or non-adjustable rod ends and with or without rod ends. Self-adjusting "U" cup seal on pistons and self-adjusting rod wipers.

- Honed Steel Barrel
- High tensile, hard chrome-plated rods.
- Packings available for extreme high and low temperatures and most non-inflammable fluids
- Delivery schedules and lead times rigidly maintained

Tell Us Your Design or Application Problems. We'll Work with You to Solve Them.

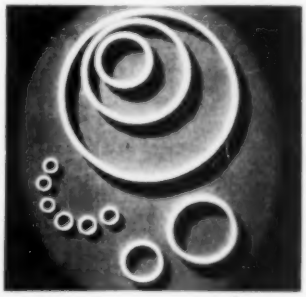
WRITE TODAY!
FREE copy of Hydraulic Cylinder Engineering Reference Data Manual. Save hours of time in specifying cylinders. 78 dimensioned basic designs for general and special purpose double-acting cylinders.

BENTON HARBOR BH EW ENGINEERING WORKS, INC.
622 Langley Avenue St. Joseph, Michigan

CIRCLE 16 ON TIME-SAVER CARD

TEFLON O-RINGS
. . . have mirror-finish

Features: Manufacturing process gives exceptionally smooth surface and eliminates all raised flash. This lets O-rings be made to close tolerances. Low friction with no external lubrication. Stable to 500 F and will not extrude or twist under pressure. Over 140 stock sizes and can be made in special sizes.



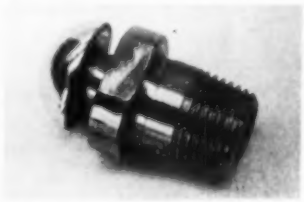
Chicago Gasket Co.
Chicago, Ill.

CIRCLE 307 ON TIME-SAVER CARD

BLEED-OFF VALVE
. . . is stainless steel

Designation: V8B-2

Features: Chrome-plated push-button head. O-ring seal. Pressures to 150 psi. Effective orifice 3/32 dia.

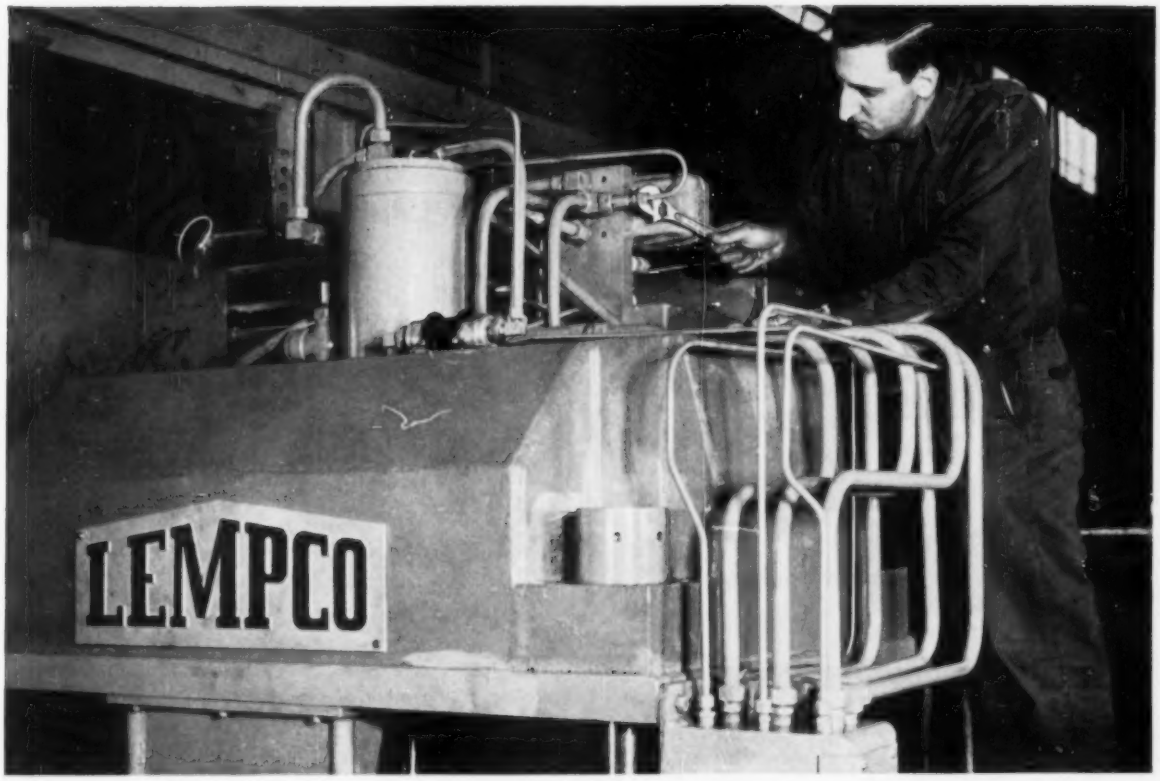


Push-button head shaped and supported for operation by axial, angular or perpendicular force. Body threads ⅛ in. NPT. Can be cam or manually operated.

Hause Machines Inc.
Montpelier, Ohio

CIRCLE 308 ON TIME-SAVER CARD

For more NEW PRODUCT reviews turn to page 110



LEMPCO . . . builds dependability into 100-Ton Press with Republic ELECTRUNITE Hydraulic Line Tubing

Through the years, LEMPCO Industrial, Inc., have designed, engineered, and built hydraulic presses for a variety of industrial purposes. Recently, one of their most critical customers included resistance welded tubing as acceptable in their specifications.

Republic ELECTRUNITE® Hydraulic Line Tubing was used for this order of 100-ton presses for molding plastics. Result: Greater built-in dependability and economy.

With ELECTRUNITE, quality is built-in. ELECTRUNITE is produced from highest quality flat-rolled open-hearth steel made in Republic's own mills to Republic's rigid specifications.

The exclusive ELECTRUNITE process is a continuous electric resistance weld method that unites the wall under pressure without the addition of foreign or added metal. Both the inside and outside surfaces can be checked for defects. Quality you can measure is built-in.

ELECTRUNITE is uniform. Uniform heat treatment assures uniform flaring characteristics. Close dimensional tolerances maintained in the drawing operation assures ease of assembly, reducing installation and maintenance costs.

Exacting outside dimensional tolerances assure a tighter joint at the fitting, reducing the possibility of leakage. And the overall uniformity of ELECTRUNITE assures fast, economical assembly with either flare, non-flare, or socket-brazed type of tube fittings.

Every length of ELECTRUNITE is hydrostatically tested or FARROWTESTED® (Republic's exclusive non-destructive electrical test) to MIL-T-17188 or A-214.

To learn more about Republic ELECTRUNITE Hydraulic Line Tubing, call your distributor, or write direct.

REPUBLIC STEEL
STEEL AND TUBES DIVISION

REPUBLIC STEEL

Cleveland 8, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-6441-R
211 EAST 131st STREET • CLEVELAND 8, OHIO

Please send me additional Republic ELECTRUNITE Hydraulic Line Tubing information.

Name _____ Title _____

Company _____

Address _____

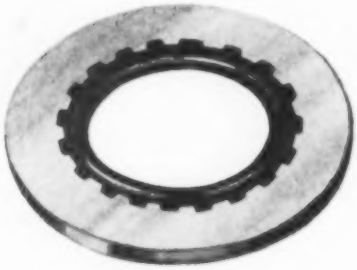
City _____ Zone ____ State _____

CIRCLE 81 ON TIME-SAVER CARD

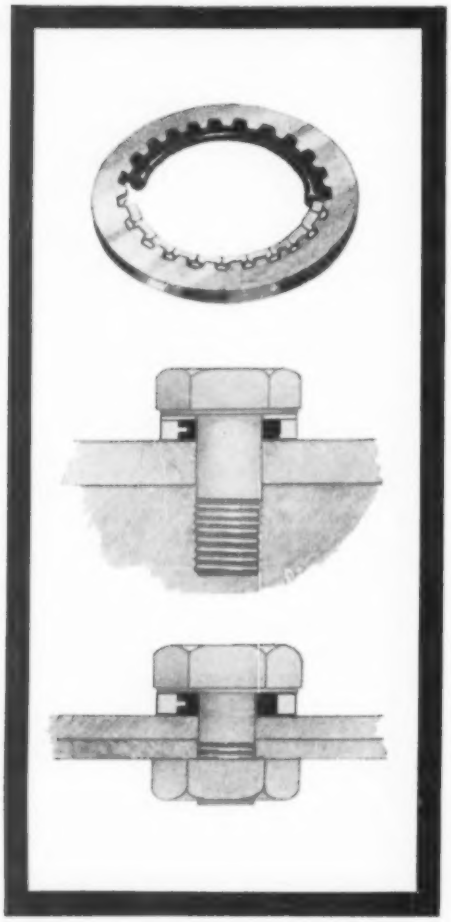
FOR SEALING-

NOW IT COSTS NO MORE

FOR THE SUPERIORITY OF



Stat-O-Seal®



Only Stat-O-Seals offer safe, sure, effective sealing using the principle of controlled confinement of the seal plus the advantages of *mechanical* "bonding".

This means they will not "twist" in installing and there is no chemical bonding agent that can be attacked by corrosive fluids. Stat-O-Seals feature:

- Metal to metal contact of faying surfaces
- Quick, visual inspection
- Easy, one piece, "twist-free" assembly
- Re-useability
- O-ring style configuration for versatility and freedom from easy damage
- Sure sealing from high vacuum to 20,000 PSI
- Standard sizes for bolts and nuts from −6 to 2" and types to seal almost any fluid at temperature ranges from −85° to +360°F.

Stat-O-Seals have been proven in thousands of vital installations and now they cost no more than ordinary seals for similar purposes.

If your product and designs require seals, why not find out how Stat-O-Seals can do a better job for you, too.

by the makers of Gask-O-Seal *and Met-O-Seal*

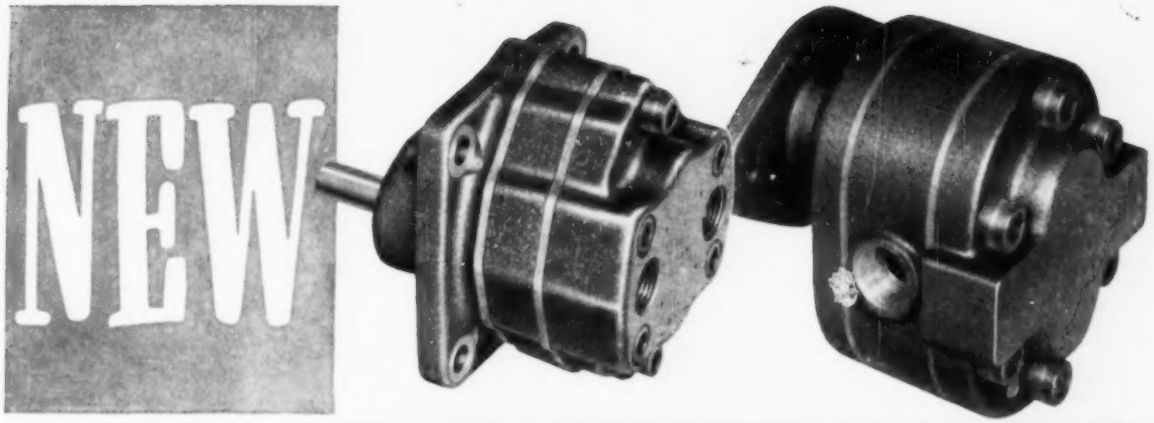
Parker SEAL COMPANY*

CULVER CITY, CALIF. • CLEVELAND, 12, OHIO

A DIVISION OF Parker-Hannifin CORPORATION

**Formerly Franklin C. Wolfe Co. and Parker Rubber Division*

CIRCLE 73 ON TIME-SAVER CARD



TUTHILL POWERMAX

Hydraulic pumps and Fluid motors

- **For pressures to 1500 psi**
- **Pump capacities from 1.2 to 14.2 gpm**
- **For speeds to 3600 rpm**

TUTHILL, producers of quality pumps since 1927, proudly announces its new line of POWERMAX hydraulic pumps and fluid motors. Produced in a complete selection of seven different models, these rugged, compact new units incorporate the quality construction and advanced engineering that industry has learned to expect from TUTHILL.

POWERMAX pumps and fluid motors use precision-ground, involute spur gears of heat-treated alloy steel, especially designed for efficient and quiet operation. Large, heavy-duty, anti-friction bearings . . . hard, long-wearing, double wear plates of a special bronze alloy . . . double lip-type shaft seals . . . generously proportioned heat-treated alloy steel shaft . . . these are just a few of the many quality construction features which insure long, trouble-free life for POWERMAX pumps and motors.

The compact design of these units saves space and simplifies installation problems. They can be provided for either flange or foot mounting and with either side or rear ports as standard (front porting is available on special order). POWERMAX pumps or motors may be supplied with a built-in relief valve if desired.

Duplex or tandem models

For applications such as power steering where two pumps of substantially different operating characteristics are required, POWERMAX pumps may be furnished in duplex or tandem models, with both units mounted on a single shaft. This allows substantial savings through the elimination of a second driving source, reductions in hydraulic piping, and lower installation costs.

A new Catalog, No. 111, gives complete information on these new POWERMAX pumps and hydraulic motors. Included are performance curves, dimensional data, construction features . . . all the detailed engineering information you need. Write today for your copy.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

☐ Please forward copy of Catalog No. 111 on new POWERMAX hydraulic pumps and fluid motors.
☐ Please have your representative call.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities From 1 to 200 GPM; for Pressures to 1500 PSI; speeds to 3600 RPM.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

PUMPS FOR YOUR PURPOSE

CIRCLE 97 ON TIME-SAVER CARD

USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

PILOT RELIEF VALVES . . . that maintain constant pressure in a hydraulic system from a remote point are featured in folder prepared by *Fluid Controls Inc., Mentor, Ohio.* Valves have a cracking pressure of 90 percent or more of the maximum relief pressure. The bulletin gives complete engineering information on the 3000 psi oil valves which are made in ½, ¾, and 1-in. pipe size.

CIRCLE 400 ON TIME-SAVER CARD

HEAT EXCHANGERS . . . made completely of 316 stainless steel in 1, 2, and 4-pass models are described in a folder announced by *American Standard, Ross Heat Exchanger Div., Buffalo, N. Y.* Units are low-cost since they are quickly assembled from a stock of mass-produced parts. Baffles are designed for the best possible heat transfer rate.

CIRCLE 401 ON TIME-SAVER CARD

SOLENOID VALVES . . . with body and all internal parts made of stainless steel are shown in a folder published by *Allied Controls Co., New York, N. Y.* Valves have soft synthetic plungers that are spring-loaded allowing them to be mounted in any position. Made in ⅛ and ¼ in. for pressures to 400 psi.

CIRCLE 402 ON TIME-SAVER CARD

ROTARY PUMPS . . . mounted integral with electric motors, have capacities from 0.3 to 55 gpm at pressures to 400 psi, are presented in a catalog issued by *Roper Hydraulics Inc., Rockford, Ill.* Driven gear is mounted directly on the motor shaft eliminating need for flexible couplings. Seals on drive shaft can either be lip-type or mechanical.

CIRCLE 403 ON TIME-SAVER CARD

HYDRAULIC COMPONENTS FOR MOBILE EQUIPMENT . . . are featured in a pamphlet available from *Parker-Hannifin Corp., Cleveland, Ohio.* Included are control valves with capacities from 10 to 175 gpm in single and multispool design for pressures to 2000 psi; hydraulic accumulators in sizes from 10 cu in. to 10 gal; mobile equipment cylinders with bore sizes 1 to 16 in. and strokes to 20 ft; and a complete line of hydraulic hose assemblies and tube fittings.

CIRCLE 404 ON TIME-SAVER CARD

FIBER CARTRIDGE FILTERS . . . for full-flow depth filtration of all types of hydraulic fluids are covered

in a booklet from *The Cuno Engineering Corp., Meriden, Conn.* Complete information is given on the selection of proper filter and cartridge. Curves and tables indicate life and flow rates of cartridges. Filters with capacities to 2000 gpm are illustrated.

CIRCLE 405 ON TIME-SAVER CARD

PISTON ROD DEFLECTION . . . and methods for minimizing cantilever forces produced by rod sag are detailed in a data sheet published by *Miller Fluid Power Div., Melrose Park, Ill.* Included are tables with shaded sections indicating the danger area where sag in long-stroke rods cause excessive bearing wear. Data covers cylinders with strokes to 24 ft.

CIRCLE 406 ON TIME-SAVER CARD

TUBE & PIPE FITTINGS . . . of the flare, no-flare, self-flare, and metal-to-metal seal types are printed on a wall chart available from *Flodar Corp., Cleveland, Ohio.* Diagrams of more than 50 types of fittings in steel, stainless steel, brass, and aluminum are shown along with instructions for installation and a table for tube size selection.

CIRCLE 407 ON TIME-SAVER CARD

AIR BOOSTERS . . . and air and low-pressure hydraulic cylinders are illustrated in a folder prepared by *Lynair, Inc., Jackson, Mich.* Boosters can be furnished in ratios from 1½ to 1 to 6¼ to 1 for air-to-air or air-to-hydraulic. The folder contains cut-away drawings and charts showing the features of both cylinders and boosters.

CIRCLE 408 ON TIME-SAVER CARD

ELECTRIC MOTORS . . . weather protected for outdoor operation under extreme weather conditions are described in a leaflet produced by the *Louis Allis Co., Milwaukee, Wis.* Cutaway drawings illustrate construction which is impervious to high winds, driving rain, snow, sleet, and sandstorms, while using the surrounding air for cooling.

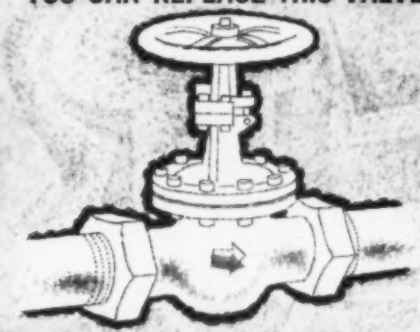
CIRCLE 409 ON TIME-SAVER CARD

TRIPLEX PLUNGER PUMPS . . . for capacities to 225 gpm and pressures to 11,700 psi are presented in a catalog announced by *Worthington Corp., Harrison, N. J.* Included are charts, photographs and sketches indicating construction, capacities, dimensions, and materials.

CIRCLE 410 ON TIME-SAVER CARD

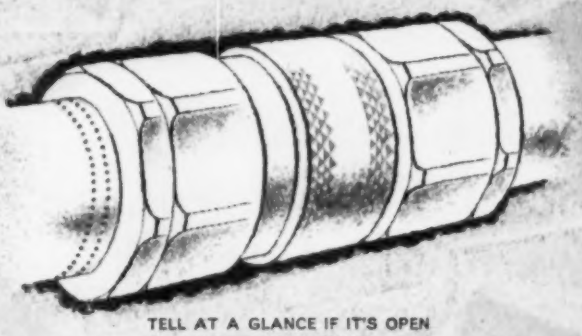
For more reviews of FREE LITERATURE turn to page 114

YOU CAN REPLACE THIS VALVE



NO WAY TO KNOW IF IT'S OPEN OR SHUT WITHOUT TESTING.

WITH THIS SNAP-TITE VALVED COUPLING



TELL AT A GLANCE IF IT'S OPEN OR SHUT . . . NO TESTING.

A CHALLENGING NEW CONCEPT-

AUTOMATIC VALVING

The *instant* the two halves of the Snap-Tite valved coupling are connected there is full, free flow through it. No tedious turning of wheels as in conventional valves. When you want to shut off the Snap-Tite valved coupling, you just pull back the sleeve. You can tell at a glance the line is closed.

Leakage past conventional valves is difficult to find . . . not so with Snap-Tite valved couplings! Further, Snap-Tite valved couplings take up less space. So, why not switch to Snap-Tite automatic valving? Eliminate the possibility of incorrectly set or leaking valves and save time in installation and maintenance. Investigation might show considerable savings.

Sizes ¼" to 10" of all machineable metals

For more information, write for Snap-Tite catalog and, if you wish, outline your problem. Your local Snap-Tite representative will be glad to advise you.

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

★Snap-Tite, INC.

UNION CITY [illegible], PENNSYLVANIA

CIRCLE 90 ON TIME-SAVER CARD

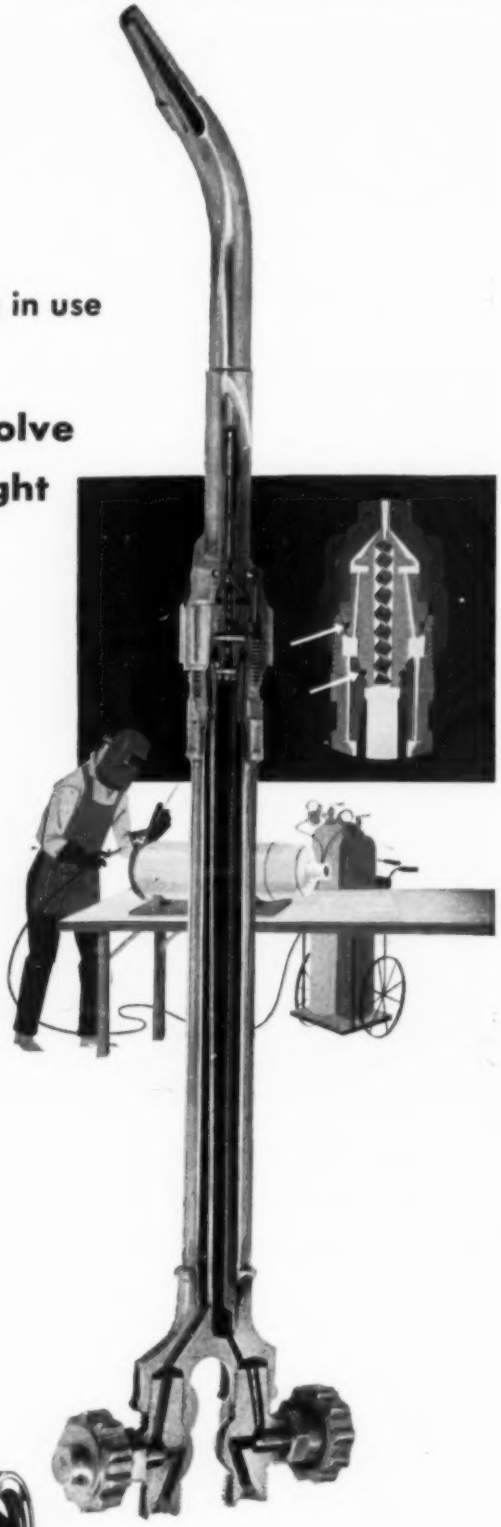
Ozone deterioration

Continuing stress

Gas leakage

Rough handling in use

New National Hypalon O-rings solve these problems; insure a hand-tight gas seal in Victor Torches



As static seals, commercial Buna N O-rings performed satisfactorily in Victor welding torches — *when the rings were new.*

However, ordinary O-rings age fast in welding torches. They receive rough treatment when welders change nozzles; nozzles are often dropped on the ground to lie there until needed again. Severe ozone deterioration is experienced. Continuing stress, although mild, impairs O-ring elasticity. Rings on welding nozzles are sometimes subjected to long shelf life.

National Seal engineers developed a new O-ring compound, National Hypalon L-11, which not only withstands rough handling, ozone deterioration and stress but exhibits many times the shelf life of Buna N compounds previously used. Today, National Hypalon is standard at Victor.

Special compounding to meet unusual conditions is a basic part of National's complete O-ring engineering service — service available from National Field Engineers in major cities nationwide.

NATIONAL SEAL
Division, Federal-Mogul-Bower Bearings, Inc.
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CIRCLE 67 ON TIME-SAVER CARD

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New!

GREER PRECISION THROTTLING VALVES WITH INTERCHANGEABLE PORT FLANGES

A proven and exclusive valve line available in 6 line sizes up to 2". Greer's universal design concept provides maximum flexibility and standardization for virtually all hydraulic systems. Cuts installation, maintenance, spare parts and other costs.

Write for descriptive Greer Brochure TV-12

THE GREER NETWORK OF SALES OFFICES AND REPRESENTATIVES is now located in cities from coast-to-coast, and is expanded with the addition of a new west coast sales, service and manufacturing facility.

All Greer representatives are specialists in the field of fluid mechanics, and provide know-how and experience in the application of Greer Accumulators and hydraulic components to modern machinery and equipment. Greer distributors and sales offices carry a complete inventory of accumulators and spare parts for prompt, on-the-spot sales and service.

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CIRCLE 41 ON TIME-SAVER CARD

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TEXACO

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

CIRCLE 94 ON TIME-SAVER CARD

APPLIED **Hydraulics** & **Pneumatics**
DECEMBER 1958

Components for mobile equipment

DESIGNERS ASK . . .
About what's available . . . What's in development

MANUFACTURERS REPLY . . .
About present products and future plans and trends

Knowing what's available is important for good design. Here's a survey AH & P editors made to couple the needs of designers to the products of manufacturers.

PUMPS AND MOTORS

There's a need for better quality pump-valve-tank units in 5 to 10-gpm sizes. Belt-driven units are being used for power steering.

Since the PVT unit must be installed at the engine take-off, you've got to have a valve linkage to the operator's controls. This extra installation cost often balances out the price advantage offered by a PVT unit. This is one reason some users are no longer using PVT units in their designs.

We're concerned about efficiency and wear of gear pumps operating at high pressure.

New gear pumps are available for 2000-psi operation. In one design, internal forces are taken against a thrust bearing instead of wear plates. Piloted construction of housing and end covers prevents distortion at top pressure. It also keeps the pump bearings accurately aligned.

Until recently only a few pumps have been available for 2000-psi service, and these are relatively low volume units.

A new line of vane pumps has been developed for 2000-psi operation. They have a large increase in power with very little increase in size. Improved under-vane porting insures positive vane tracking of the cam-ring at speeds to 2000-rpm. Capacities now available range from 12-gpm (SAE rating at 1200-rpm, 100-psi.) to 50 gpm. Pumps with deliveries to 200 gpm are in the works.

There's a real need for a variable delivery pump and variable displacement motor priced realistically for mobile use.

Price barrier has yet to be broken here. At least one manufacturer of pumps for mobile equipment has a variable delivery vane pump under test. And for a hydrostatic transmission to propel a lift truck, variable displacement, axial piston motors are being used by Towmotor Corporation. This line of trucks was introduced about sixty days ago.

A line of piston pumps for mobile use is designed so that it's possible to isolate flow into two or more separate circuits selecting the pistons and using isolator valves. You can make a double or triple pump at very low cost. Variable volume piston pumps with manual, pressure-compensated and volume-compensated controls are in development. Hydrostatic transmissions for propelling vehicles will become more common in the next five years. Cost factor in some applications is now 1.5:1 compared to mechanical transmissions. In other applications, the ratio is even lower.

VALVES

How about higher capacity components? Valves for 100 to 150-gpm are needed. There's a definite shortage in the mobile equipment field of large volume units.

You can buy 150-gpm valves for directional control. Applications are limited to very large earthmoving machines. You may ask why not go to higher pressures for big jobs instead of high flows? One answer is column strength of cylinders which have to be rugged enough to bear the loads.

When our machine is in the field, we want to be sure that the user can readily replace a section of a multiple unit valve without getting it too tight or improperly seated.

Multiple unit valves are available with a seal-plate valve assembly with bonded rubber seals. This seal plate permits rapid, leakproof assembly without cramped valve spools or overstressed belts.

On some manually controlled valves we find that spool reaction forces hold or push the valve in a position different from the control position as the valve is actuated. This disturbs the operator's feel.

Proper valve sizing is the answer here. A valve too small for the job can give this objectionable reaction force. As pressure and volume go higher, reaction force gets bigger. Short valve strokes also add to the problem. Valve capacity is determined just as much by reaction force as it is by port size. One solution being considered is pilot operation, but the problem is how do you generate pilot pressure during engine idling? An accumulator or separate pilot pump may be needed.

With as many as six, 1-inch hoses connected to a valve, it's sometimes necessary to remove the valve before applying a wrench to remove the hoses. This is because ports are spaced too closely on some directional valves.

Maybe here's a case where you can't have your cake and eat it too. Closely spaced ports have given the compactness that many designers want, and this compactness has often offset plumbing difficulties. The same design which results in compactness also gives efficiency in timing the opening and closing of internal ports. Straight-thread fittings and bent tube hose ends help where ports are close.

We're troubled by relief valves that are integral with directional controls and have as much as 400-psi difference between cracking and wide open pressure.

You shouldn't be. There are pilot-operated relief valves built into directional controls which have less than 7% differential at 1500 psi. Adjustable range is 500 to 2000 psi. Capacity, 20 gpm. Operation is quiet. Remember, cutting down the differential increases pressure surge, and pilot-operated relief valves need clean oil for proper service.

We want to replace valve spools in the field. It's tough to do on today's directional controls.

Be careful here. Unknowing repairmen sometimes use lapping compound to work in the spool. This works into the valve casting, and is never completely removed. Lapping goes on for the life of the valve. Field replacement of spools isn't recommended by most valve manufacturers, but at least one manufacturer does code bores and spools for size, so that field replacement is practical.

There's a need for speed controls built into valves which are remotely operated.

Coming on the market soon will be multiple unit valves with solenoid, servo, or pilot control. Remote installation with compact electrical connections to the operator's location will be easy.

How about a tamper-proof relief valve? One which needs a special tool to reset.

This is an education problem rather than a design problem. Unfortunately, about the first thing a repairman learns to do on a machine is to screw down the relief valve. Special tools are only half an answer because they also are a problem to the qualified serviceman. Often the relief valve can be installed in a way to discourage tampering.

Power steering equipment has too many components. We want more compact units. Especially for large trucks.

In most installations, power steering is an assist to the standard mechanical steering gear. However as vehicles become larger, they are harder to steer with this method. A new all-hydraulic steering system which completely eliminates heavy, inflexible mechanical gear is now operating in several experimental installations.

The steering wheel actuates a servo valve which controls single or multiple steering cylinders at the wheels. Limited steering is provided in case of a power failure. The control valve can be mounted wherever it is most convenient for the operator, the cylinders can be mounted for best thrust. Lines are flexible hose rather than expensive forgings for linkage.

Average directional valve spool travel is 3/8 inch. When there's room, we add a linkage to give more travel to the operating lever. Why can't spool strokes be increased to 1 inch.

Longer valve stroke would be fine but it's not easy to get. Length of the valve is also affected. To go from

⅜-inch stroke to 1-inch could increase overall valve length by 10 inches!

Closed-Center systems offer advantages. How about more valves designed for these circuits?

Up to now, most mobile equipment circuits have been open center. Demand for closed-center system components will bring the necessary directional valves, unloading valves and variable volume pumps.

PACKINGS

We've had trouble with O-rings for piston packings. Life of the original O-ring is always less than the replacement.

Assuming the same packing material was used for initial installation and replacement, check O-ring groove design. There have been cases of rubber wearing out metal with wrong groove dimensions or cylinder finish. Use backup rings for higher pressures. And for rugged service—shock loads, exposure to weather—look to cups, V'S and U'S for longer life as piston seals.

Accurate data on service life of packings is not available. Information from the manufacturer should help determine how long a packing unit will last.

Life of a packing depends on many factors: temperature, contacting metals, finishes, pressures, pressure cycling, surges, type of fluid, and speed and length of stroke. The machine may operate in an atmosphere of dust or deteriorating gases. The fluid, and how it's filtered, also affect packing life. Test data can be supplied at any temperature, but it's up to the equipment designer to test under his particular conditions and in his own machine. Information on durometer change, tensile strength, specific gravity, elongation, compression set, and other characteristics is available but the real test is how well the seal works in the machine under actual working conditions.

Why can't we get a universal packing material to be used for both petroleum and synthetic fluids?

Manufacturers of packing materials recognize the need for a universal packing which is compatible with all fluids, and they have very active development programs. The newer elastomers such as fluorinated materials may be the answer. Leather impregnated with thiokol is compatible with all the fire-resistant fluids. This material has shown the least amount of swell of any material tested with the exception of Teflon. There has been some recent work with Teflon as a coating over standard packing. The work is complicated by the continuing introduction of new fluids. Moving seals are much more of a problem than static seals which are not so subject to deterioration by the fluid.

How long will we have to have a high finish gland surface for dynamic O-rings?

Sometimes groove finishes are better than necessary. All surfaces do not require as high a finish as the moving surface. Specify a surface finish of 32 RMS on the grooves, 16 RMS on the moving surface and *hope* to get it. 100 RMS has been satisfactory for static seals. Some of the fine tolerances are a holdover from the original installations of O-rings in aircraft applications, and industry is in a process of downgrading from these.

FLUIDS

Because fluid foaming causes cavitation, it reduces pump life. What can be done to reduce foaming?

Proper reservoir baffling, use of fluid with foam inhibitor, pumps and suction lines designed to prevent air entry are answers. A greater quantity of fluid also helps. Water in the fluid promotes foaming. Design the reservoir with baffles to prevent fluid from sloshing around. Keep the pump intake well below the surface.

Can we buy fire-resistant fluids which won't foam, won't harm packings, and work at temperatures from —30 to 120 F?

Water base fluids with viscosity indexes in the range of 150 to 165 can be supplied for use from —30 to 150 F. They work well with Butyl packings (which are also compatible with phosphate ester fluids) if petroleum base fluid has never been used in the system. Phosphate ester fluids are also available for —30 to 120F or more.

Because of poor condition of water in coal mines why can't we get a ready-mixed water base fluid to be used for make-up?

Adding ready-mixed make-up would constantly enrich the fluid in glycol, as water is lost by evaporation. Deionized water containing vapor-phase, corrosion inhibitors would be the addition needed.

HOSE & FITTINGS

One of the primary needs is for higher pressure hose.

New 4-spiral and 6-spiral hose is now available. It is almost as flexible as 2-wire braid hose. Expect it to be more expensive than hose for 1500 psi, but it requires only about 1 inch more on bend radius compared with 2-wire braid hose. Hose in sizes under 1 inch for 5000 psi is now available. Spiral wrap is now available in sizes from ¼ to 1½ inch. Under test, spiral wrap, ⅜-inch hose burst at 55,000 psi.

What other methods of connecting hose to components and tubing have advantages over pipe threads?

The SAE, split flange clamp is easily installed with a small wrench, and seals with an O-ring. It is available in pressed-on or clamp type couplings.

We feel the use of straight-thread fittings presents a field procurement problem. What's the availability of components with straight threads?

Pumps and valves are now being shipped with straight threads. Here's why you benefit: Even the greatest care in machining and gaging the internal and external pipe thread will not assure a leakproof connection under varying pressure. Overtightening of the pipe threaded fitting can damage threads or even distort or crack the body of a valve. The SAE, straight-

thread boss with O-ring sealing is a compact design requiring the same space as the old tapered pipe thread. It does not leak even at higher pressures and has the advantages of easy assembly and reassembly without damaging the fitting.

Hose life has been a problem because of the severe usage on our machine. One end of the hose assembly is fixed and the other vibrates at 2200 cycles per minute. While this is unusual service, we would like more than the half-season life we are now getting. Increasing the flexible rubber length helps.

Perhaps this is an application for a combination of swivel joint and hose. This particular application represents an unusual temperature control problem. Heat is generated by friction in the metal hose braids, and this cuts hose life. Hose with a high temperature inner tube may work.

We need a good flareless fitting for use with copper air lines. We are now using a 45-degree flare fitting, but feel manufacturing costs could be cut with a flareless fitting.

Copper tubing is commonly used for air lines. Brass flareless fittings are available. On some types the tube is inserted into the fitting through the tube nut and ferrule until it bottoms on a shoulder inside the fitting body. Then the nut is tightened causing the ferrule to bite into the outer surface of the tube. The fitting withstands severe vibration. It can also be used with plastic tubing.

A recent brass flareless fitting provides a butt joint without tube entry into the body of the fitting. This not only simplifies and speeds installations, but makes a perfect alignment and eliminates tube and sleeve tension which tends to reduce joint reliability.

We feel manufacturers could improve on bending radii to permit sharper bends.

Many hose problems result from letting the hydraulic piping go until last in the design of the machine. Then it's too late to alter component installations or change design of the machine. Curved tube, hose connections often work well where hose must have a sharp bend. Swivel joints and hose often make an excellent combination for very short bend radius and high pressure.

Hose abrasion is a problem. We have noticed scuffing and wear of the cover. One reason for this rubbing is increased flexibility as the system heats up. The hose sags and interferes with other parts causing abrasion.

Present hose coverings are satisfactory for the average user; more abrasion resistance would boost the cost. Clamps, use of tube and hose, angle fittings are some techniques that help. Plastic or steel covers can prevent abrasion and asbestos firesleeves can be used in unusual applications. Proper routing of lines will eliminate most chafing problems.

Does the idea of vulcanizing or permanent bonding of the fitting to the hose have merit?

Most of our hose assemblies are strongest at the fittings. Blow-offs are almost always due to improper assembly, not to the design of the fitting. The tensile load of a high pressure fitting is more than a bond could take.

Why can't identification be marked permanently on the outside of hose covers to prevent improper installation?

Hose manufacturers must work toward standardized markings. SAE has standards (they should be brought up to date) but only a few manufacturers are now using them as identification marking on their hose. The designation should show hose construction and reinforcement. Many times fluid lines are painted with the machine and this covers the identification. However the hose may still be identified from the fitting.

Editor's Note to designers and users of fluid power on mobile equipment: If you want information about components you need write:

APPLIED HYDRAULICS & PNEUMATICS
812 Huron Road
Cleveland 15, Ohio

APPLIED HYDRAULICS & PNEUMATICS thanks the following men and companies who contributed information for this survey of fluid power components for mobile equipment.

Aeroquip Corporation

Anchor Coupling Co., Inc.

Bearings, Incorporated
R. C. Van Lew

Capital Engineering & Manufacturing Corporation

Commercial Filters Corporation

Denison Engineering Div., American Brake Shoe Co.
E. Borne

Dynex, Incorporated
W. R. Master

Greer Hydraulics, Incorporated

E. F. Houghton & Company
L. R. Tharp

Hydreco Division, New York Air Brake Company
R. R. Mease

Imperial Brass Manufacturing Co.

Marvel Engineering Company

Parker-Hannifin Corporation
M. Murray, F. O'Patrny, R. W. Phillips, C. J. Giblin, H. H. Schmiel, J. Hinske, E. C. Davis

Precision Rubber Products Corp.

Purolator Products, Incorporated
H. L. Forman, S. C. Sauer

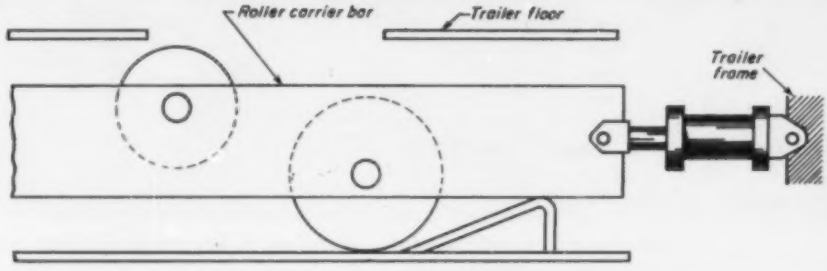
Racine Hydraulics & Machinery, Incorporated

Union Carbide Chemicals Co.

Vickers, Incorporated
P. Kubik

Webster Electric Company

AIR MOTOR and PUMP assembly are mounted on the frame of the trailer close to the operating cylinders. Air storage tank at left is pressurized from brake system.



IDLER ROLLER on bottom of roller carrier bar is pulled up on slanted cam to extend upper roller through the slot in trailer floor.

Air motor drives pump on truck conveyor

TO SAVE time and labor for a California beverage distributor The Standard Trailer Co., San Leandro, Calif., built a disappearing conveyor into the bed of a trailer. Hydraulic cylinders raise a set of rollers on each side of the trailer from a position beneath the floor.

• **Pump Drive**—The hydraulic pump for the system is driven by an air motor mounted under the tailgate near the control valve and cylinders. This arrangement eliminates long hydraulic lines with disconnect couplings running from the cab to the rear of the trailer. Air pressure normally piped to the trailer for brakes is used for pump drive.

A small air storage tank mounted on the trailer frame near the pump unit maintains a supply of air for operating the air motor. This tank is pressurized by a bleed-off from the main storage tank for the pneumatic brake system.

• **Roller System**—Pallets move on four lines of rollers raised through cutouts in the trailer bed. When the van is loaded, the rollers are retracted.

Fore and aft movement of a roller carrier bar raises and lowers the rollers. Idler rollers on the bottom of the carrier bar are pulled up an incline extending the top rollers through the openings in the trailer floor. Single-acting hydraulic cylinders raise the rollers. They are lowered by gravity.

• **Hydraulic Circuit**—The pump delivers 0.9 gpm at 1500 psi and 1750 rpm. The air motor will develop 0.67 hp at 1750 rpm with 60 psi air pressure. Cylinders are operated by one 3-position, 4-way manual valve. Only one set of rollers is raised at a time. ▼▼▼

BACKHOE ATTACHMENT of the Hydrohoe is interchangeable with crane. Hose is 3-wire braid, compensated, and also 4-spiral wound. Two-wire braid, 2-spiral wound hose is being tested. Tubing is from SAE 41-30 steel which has about double the strength of SAE 1010. It's rated for 30,000 psi. Accuracy is important in O-ring grooves of cylinders. Backup rings of rubber impregnated leather or Teflon are always used.

6000-psi hydraulics powers the Hydrohoe

• By O. S. Perkins

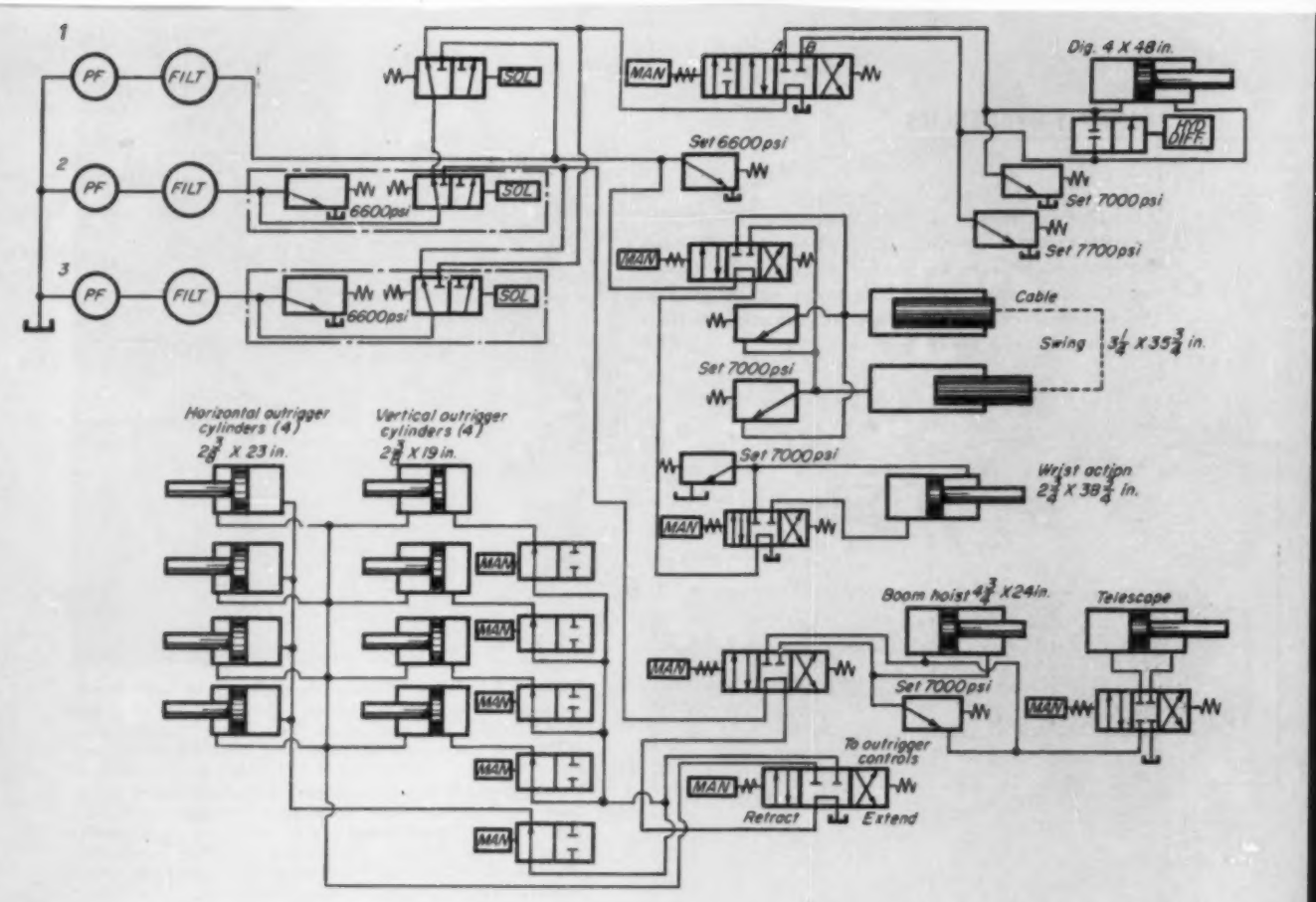
Engineer-in Charge, Hydrocrane Div., Bucyrus-Erie Co., S. Milwaukee, Wis.

MOST mobile equipment designers think they're going to have to work with higher pressures in the future to get the power they'll need and still keep size down. But the problems of sealing and filtering are a mystery to most engineers, so they're waiting to see what the next fellow does first.

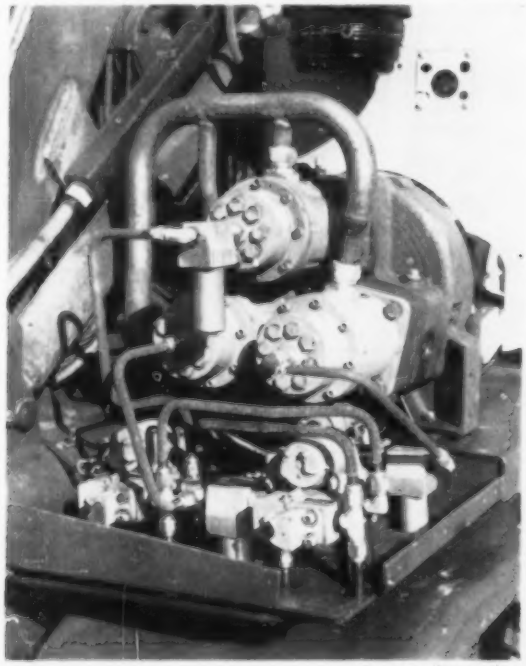
One company that has plunged into higher pressure design is Bucyrus-Erie who has come up with a combination crane-backhoe that can lift 12 tons with a 90-hp hydraulic system, yet squeezes down to 35 ft long by 11 ft high as a crane.

Contrary to what most people in the industry think, Bucyrus-Erie engineers have found no special problems that are different from designs at lower pressures. They've used components designed for this service—poppet valves, axial piston pumps, high pressure filters, and spiral wound hose—and they're getting the advantages of compactness and better heat dissipation at higher pressure. Boosting pressure four times lets you cut cylinder bores in half and lowers fluid under pressure to one-fourth. One word of caution—be careful of column buckling with the smaller cylinders.

The smaller amount of fluid means smaller lines, and the higher pressure makes line loss due to friction



COMBINATION RELIEF AND 3-WAY VALVES control pump output to the three valve banks for doubling the speed of any operation. Pump 1 normally supplies SWING rams, can be augmented by pump 2 if this pump is not supplying the BOOM HOIST cylinder and outriggers. Pump 2 normally supplies the DIG cylinder and can be assisted by pump 3. Pump 3 supplies the BOOM HOIST cylinder and outriggers and can be helped by pump 2.

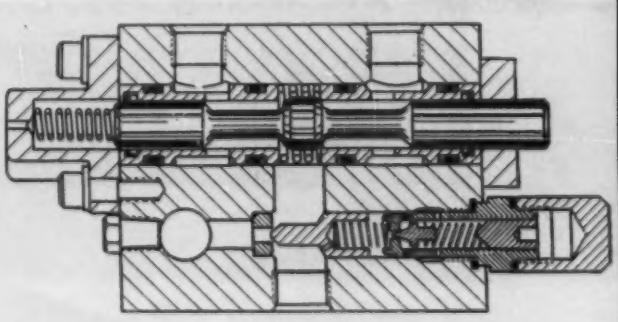


Courtesy Dynex, Inc.

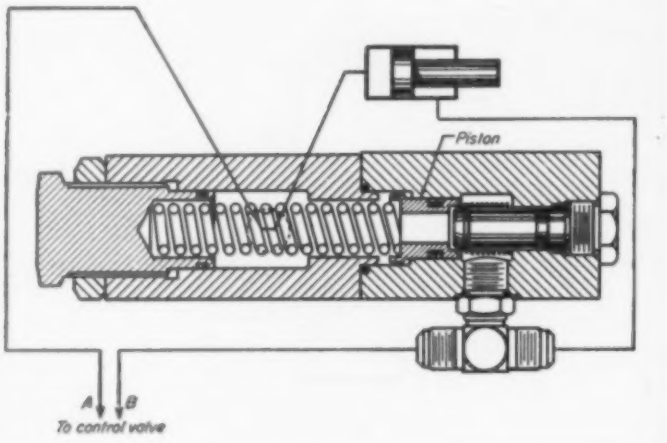
THREE PISTON PUMPS are driven through planetary gearing from a 107-hp, 6-cylinder engine. Engine governor is set at 3000 rpm no-load speed giving a pump speed of 2000 rpm. Solenoid-operated selector relief valves are mounted below the pumps. High pressure, line filters protect system against pump failure, need changing very seldom.

Filtering in the reservoir is done with a separator plate that extends from the bottom to the top of the tank and divides it in two. Top half of the separator is covered with a fine-mesh screen.

SELECTOR RELIEF VALVE is combination balanced piston, relief valve and solenoid-operated, 3-way poppet. Relief is set at 6600 psi. 12-volt, d-c solenoid which operates 3-way is actuated by the operator with switches on his control valve handles.

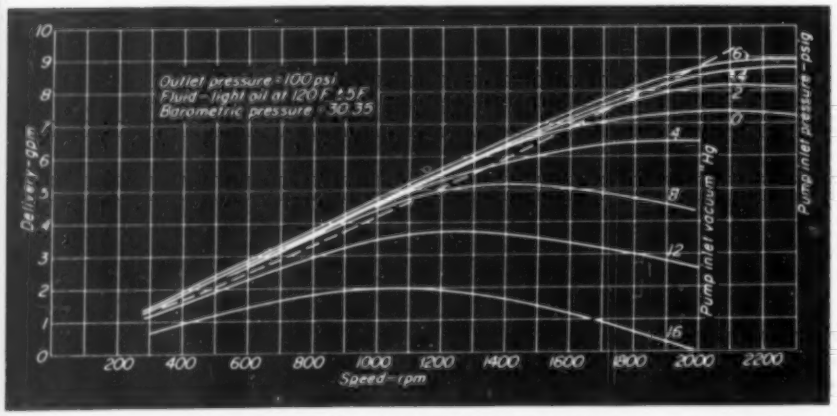


a smaller percentage of the system pressure. It also improves heat dissipation (the Hydrohoe has no cooling system) because for similar geometrical volumes, surface area varies as the 2/3 power of the volume. As volume decreases, the ratio of radiating surface area to volume actually increases. ▼▼▼



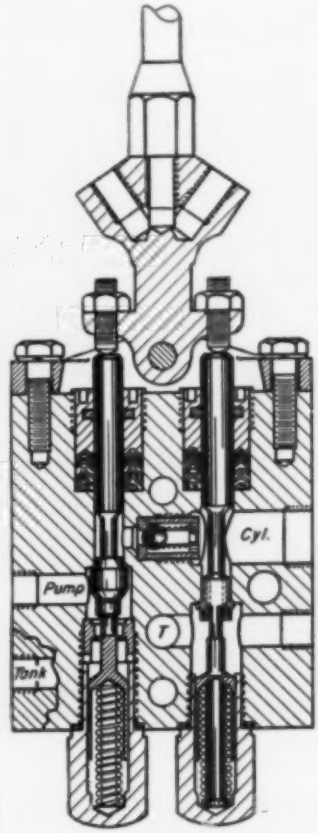
THREE VALVE BANKS, each made up of four, 3-way sections, control swing, boom hoist and telescope, dig, wrist action, and outriggers. Two 3-way, poppet type valves are connected together and controlled with one lever to make a 4-way for the double acting cylinders. Rotary 2-way valves at operator's left control flow to the four vertical and four horizontal outrigger cylinders. They permit positioning each outrigger individually according to terrain. Pushbutton switches controlling the selector-relief valve solenoids are mounted under rubber covers on three of the valve levers.

DIFFERENTIAL VALVE either connects flow from the rod end of the DIG cylinder back to the head end for fast, low force operation (differential circuit), or connects rod-end flow back to tank for slow, high force operation. When control valve connects line *A* to pump and line *B* to tank, differential valve connects cylinder flow in simple circuit. When control valve closes line *B*, pressure builds up on valve piston which moves to left, forming differential circuit.



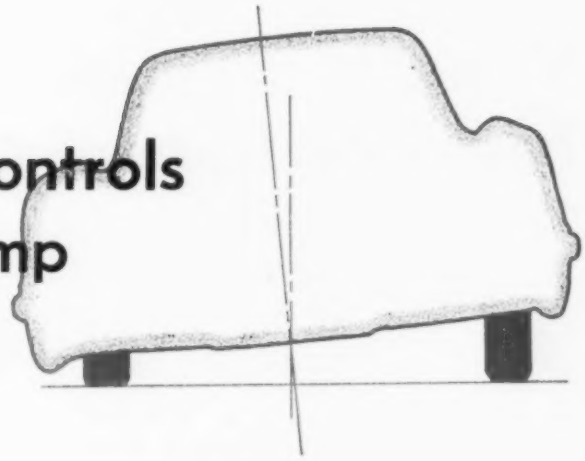
IMPROVED PUMP PERFORMANCE with inlet pressurized is shown by these curves. Reservoir is automatically pressurized by a check valve in the filler cap. First cylinder stroke in the operation draws in air through the cap. Retraction of the cylinder pressurizes the reservoir to 5 psi. Recommended operation is left and above dashed lines.

POPPET TYPE DIRECTIONAL VALVE is 3-way with an internal check to keep the load from dropping. In neutral position, pump is connected through valve to tank (through next valve in tandem).



Courtesy Dynex, Inc.

Pressure switch controls clutch - driven pump



• By F. E. Donathan, *Development Engineer, Superior Coach Corp., Lima, Ohio*

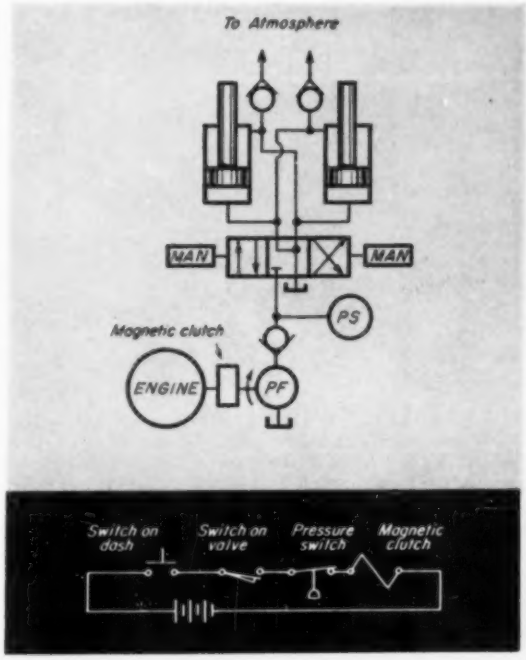
TO EASE casket handling of a side-loading hearse, leveling cylinders are mounted at the rear wheels. Since they act against the springs, pressure increases as the car tilts. A pressure switch set at 800 psi actuates the pump clutch, disconnecting the pump at maximum tilt of 6 degrees.

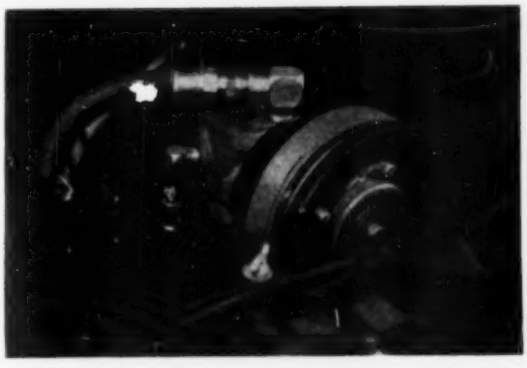
• **Operation**—The pump is belt-driven from the engine crankshaft through a magnetic clutch, and operates only while leveling. A rotary valve selects either right or left tilt. It directs fluid to the head end of one cylinder and the rod end of the other cylinder, so that one extends against its spring until pressure rises to the point where the other retracts against its spring. Pressure rises further as the cylinder retracts. At 800 psi, the pressure switch opens the electrical circuit to the magnetic clutch and stops the pump. This pressure tilts the car 6 degrees. A check valve in the pump discharge line prevents the spring from forcing oil back through the pump and holds the car in tilted position.

During driving, with the selector valve in neutral, check valves built into the cylinders let in air. This allows the cylinders to float and prevents them from transmitting road shock to the chassis. Both ends of the cylinders are mounted in rubber for flexibility.

• **Design Considerations**—The system had to be quiet for operation at funerals, and the original design used an accumulator which was charged during driving. However the pump had to run too often, and also tilt was limited by pressure drop of the accumulator.

Both vane and gear pumps were tried. A vane pump was selected for quieter operation. The rotary selector valve has the advantage of compactness for mounting under the dash board, and low handle torque for easy turning. ▼▼▼





DIRECTIONAL VALVE shown in hydraulic circuit actuates switch in clutch circuit when operated to either extreme position. Pushbutton on dash completes the circuit. Photo shows pump and clutch installation.

Versatile lift truck has many hydraulic motions

- ***Three-way power-steering***
- ***Automatic constant tilt***
- ***Automatic boom extension***

FIG. 1. FORK LIFT TRUCK with pivoted extendable boom can even pick itself up to get out of tight spots by sinking the forks in the ground and then extending them. It can go through 5 ft of water. The truck is designed to wade out and load or unload landing craft.

RECENTLY tested by the Army's Quartermaster Corps, a versatile lift truck, Figure 1, can reach out to pick up its load, shift the forks two feet either side of center, retract the load to carry it close to the truck body, move sideways, and tilt the body to pick up canted loads or keep the load level on slopes. Hydraulics plays a big part in all of this. The truck is a development of the Industrial Truck Div. of Clark Equipment Co.

• **Hydraulic Steering**—All four wheels of the truck may be steered hydraulically. A 3-position selector valve, see steering circuit, Figure 2, lets the operator choose front axle steering only, 4-wheel radi-arc steering, or 4-wheel oblique steering. With radi-arc steering, all wheels turn to tighten the turning circle; oblique steering lets the truck travel sideways, Figure 3.

A servo-type valve in the steering drag link controls both front and rear steering cylinders. The cylinders are identical. Precise synchronization of their motion is not required. But, each cylinder incorporates bypass valves to let the other piston go on and complete its stroke even though the other may have bottomed. The valves are built right into the piston and are shifted when the piston bottoms in the cylinder. This is necessary because the cylinders are series connected and bottoming of one would prevent any further flow to the other.

• **Fork Movements**—The fork carriage is pivoted on the end of a telescoping boom. The SIDE-SHIFT cylinder, mounted on the fork carriage, connects to the forks through a chain and sprocket arrangement to move the forks from side to side on the fork carriage. Two LIFT cylinders are used to raise and lower the boom which pivots on pins on the truck frame. An Extension cylinder extends or retracts the telescoping section of the boom. A Tilt cylinder pinned to the telescoping section of the boom varies the angle of the fork carriage with respect to the boom. Hydraulic connections for all of these are shown on the circuit digram, Figure 4.

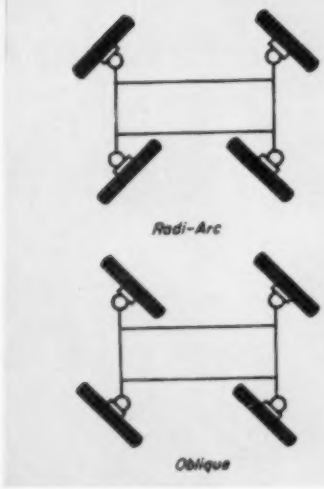


FIG. 3. FRONT AXLE, radi-arc, or oblique steering are selected by a 3-position valve. Photo shows how the truck can travel sideways with oblique steering.

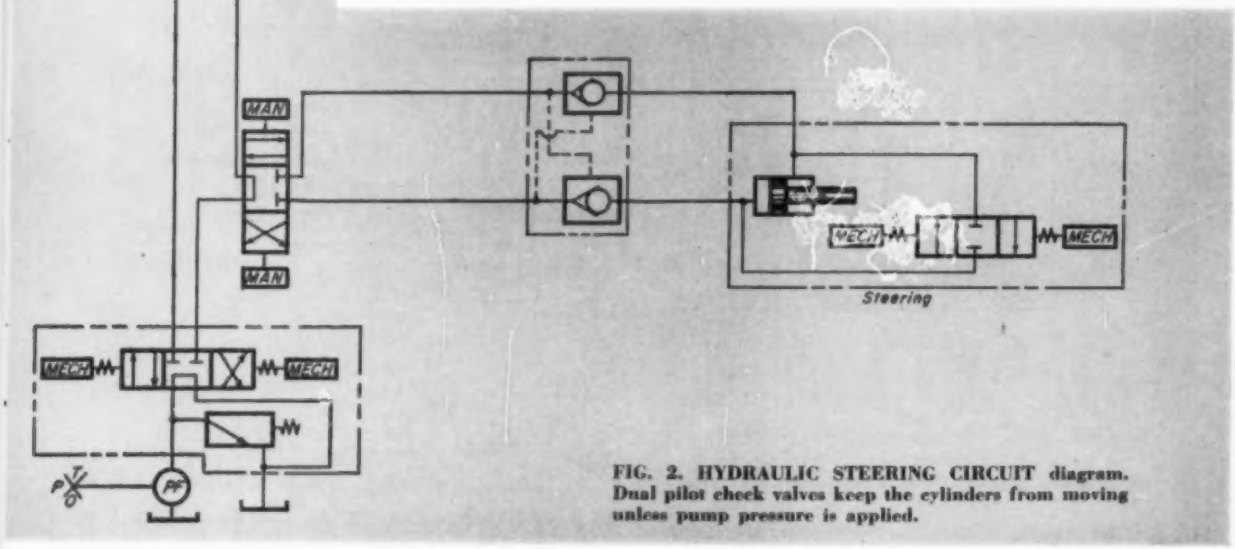


FIG. 2. HYDRAULIC STEERING CIRCUIT diagram. Dual pilot check valves keep the cylinders from moving unless pump pressure is applied.

All cylinders are controlled by 3-position, 4-way, tandem-center valves. The valves are in a bank which also includes the relief valve. A built-in check valve prevents load drop when any of the valves are shifted.

A flow-control valve is used to control lowering rate of the LIFT cylinders. The valve is designed so heavy loads are lowered at the same speed as light ones, or the empty forks. The accumulator connected to the bottom ends of the lift cylinders absorbs shocks when the truck is moving with the load supported by these cylinders. This lets the pistons move a little and returns the load to its same position.

Interference with the truck frame would prevent complete lowering of a fully retracted boom. Therefore, the frame is designed to cam or extend the boom automatically so it may be fully lowered. The relief valve at the rod end of the EXTENSION cylinder opens when this happens to keep pressure from building up to a dangerous value and let the piston extend. The check valve at the blank end lets the cylinder fill with oil from the tank at the same time.

Because the forks are at the end of a pivoting boom, raising or lowering the boom would change the tilt angle with respect to the ground unless the operator constantly changed the fork angle with respect to the boom or some automatic method were used. Since the operator really doesn't have time for this, it's done automatically.

The CONSTANT-TILT cylinder is attached, at the base, to the truck frame; see Figure 5. The piston rod is attached to an arm which is part of the lifting boom. As the boom is raised or lowered by the LIFT cylinders, oil is forced from the CONSTANT-TILT cylinder into the TILT cylinder to keep tilt angle constant. If initial fork tilt is too far off vertical, this system can maintain constant tilt only until the TILT cylinder

DESIGNER'S CHECK LIST

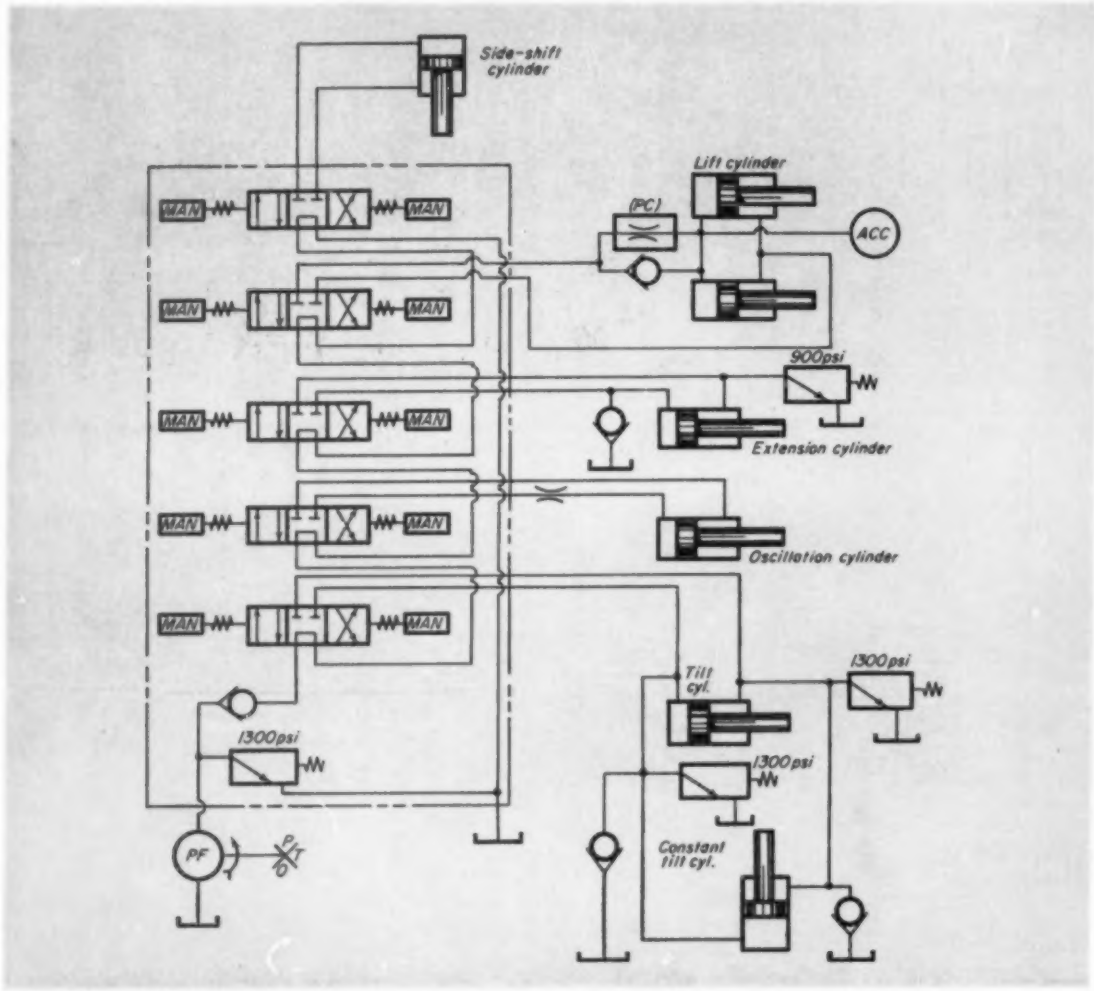


FIG. 4. HYDRAULIC CIRCUIT for fork movement and frame oscillation.

bottoms. The relief and check valves connected between the TILT and CONSTANT-TILT cylinders then let oil from the CONSTANT-TILT cylinder go to tank and keep the other end of the CONSTANT-TILT cylinder filled.

When the operator opens the valve to move the TILT cylinder and change tilt angle, oil is also applied to the CONSTANT-TILT cylinder. But, since the CONSTANT-TILT cylinder is connected to the boom, it can't move, even if the TILT cylinder bottoms, because the LIFT cylinders offer too much resistance.

The OSCILLATION cylinder shown on the circuit diagram is connected to the truck frame and to one end of the front axle. By extending or retracting this cylinder, the operator can change the angle between the frame and the axles and, therefore, between the frame and the ground. This lets the fork mechanism be kept level, within limits, even though the truck is on the side of a slope, or lets the forks be tilted to pick up a canted load. The fixed, restrictor at the head end of the OSCILLATION cylinder slows motion down to a controllable speed. Without this, cylinder motion could be much too fast for close adjustment. ▼▼▼

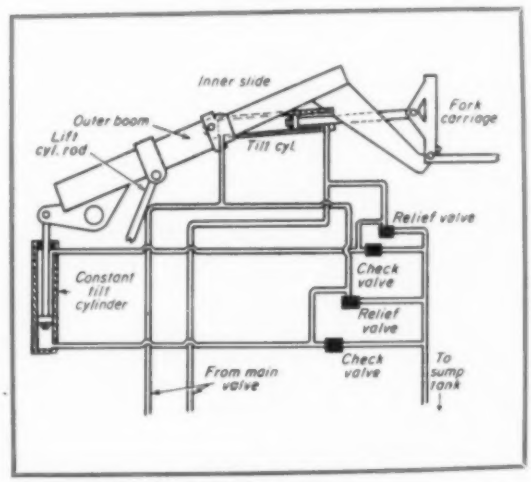
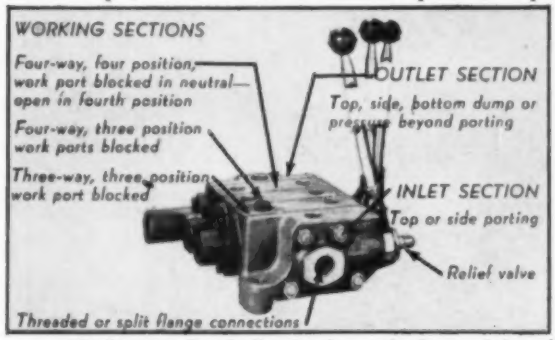


FIG. 5. CONSTANT FORK tilt system.

VALVES — CONTROL OIL HYDRAULIC POWER

flow performance as much as 20 gpm (05 series), 30 gpm (07 series) and 55 gpm (10 series) with back pressure ratings under 100 psi, non-constricted flow reduces pressure drop.


WORKING SECTIONS
Four-way, four position, work port blocked in neutral—open in fourth position
Four-way, three position work ports blocked
Three-way, three position work port blocked
OUTLET SECTION
Top, side, bottom dump or pressure beyond porting
INLET SECTION
Top or side porting
Relief valve
Threaded or split flange connections

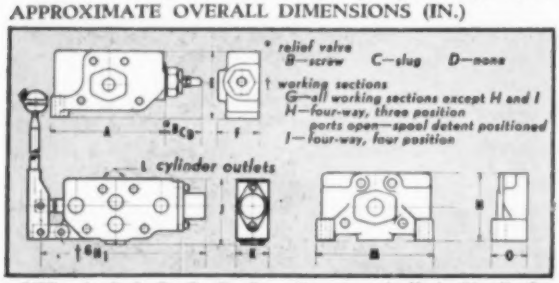
"Performance Rated" directional control valve consisting of inlet, three working and outlet sections assembled into leakproof unit. Any combination of working sections can be assembled in any sequence into a single space saving unit.

INTERNAL PRESSURE DROP (PSI)

in one four-way, three position working section when circuit is loaded — work ports pressurized.

	FLOW (GPM)										
	5	10	15	20	25	30	35	40	45	50	55
05 SERIES	5.4	21.6	48.5	86.2							
07 SERIES			22.5	40.0	62.5	90.0					
10 SERIES							37.6	49.2	62.3	77.0	93.0

APPROXIMATE OVERALL DIMENSIONS (IN.)

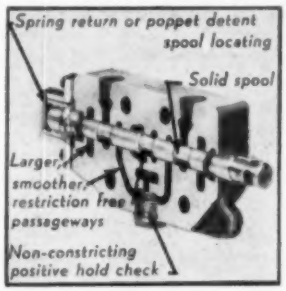

* relief valve B—screw C—slug D—none
† working sections G—all working sections except H and I H—four-way, three position ports open—spool detent positioned I—four-way, four position
cylinder outlets

SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
½"	7	2¼	1	⅛	4 1/16	2½	10	12 1/16	13	3⅜	2	½	7¼	4 1/16	2¼
¾"	8	2¼	1	⅛	4 ⅞	2¾	11 3/16	13 ⅜	14 3/16	4¾	2½	¾	8¼	4 ⅞	2⅝
1"	10	3	1¼	⅛	6½	3½	14	17¼	17¾	6¼	3	1	10½	6½	3¼

OPERATING PRESSURE 2000 PSI
O-rings seal against leakage—dense hi-tensile castings absorb stress without distorting.

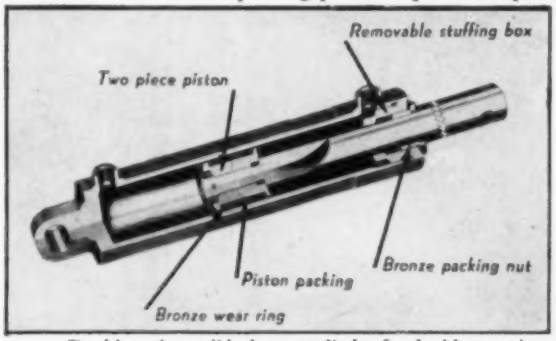
NO LOAD DROP
Positive hold check built into each working section prevents load drop or sag.

OVERLOAD RELIEF—PRESSURE CONTROL
Sensitive cartridge type pressure relief provides safety by-pass protection against overload of hydraulic system


Spring return or poppet detent spool locating
Solid spool
Larger, smoother, restriction free passageways
Non-constricting positive hold check

CYLINDERS — UTILIZE OIL HYDRAULIC POWER

single acting, double acting, telescopic capacity up to 25 tons—stroke up to 45 inches operating pressure up to 1500 psi.



Double acting solid plunger cylinder fitted with two piece piston. Disassembly for easy inspection and replacement of piston or stuffing box packings is a simple field operation. Note there is no metal to metal contact between piston and cylinder.

DOUBLE ACTING

ROD. DIAMETER		1	1¼	1¼	1½	1½	2	2	2½	2½
CYLINDER O.D.		2½	2⅞	3	3⅜	4⅞	5⅞	6⅞	8	9¼
DISPLACEMENT	PUSH	.014	.017	.021	.036	.061	.094	.133	.179	.242
	PULL	.010	.012	.016	.028	.054	.080	.119	.158	.220
EFFECTIVE AREA	PUSH	3.1	4.0	4.9	8.3	14.2	21.6	30.7	41.3	55.9
	PULL	2.4	2.7	3.7	6.5	12.4	18.5	27.5	36.3	50.9

SINGLE ACTING

PLUNGER DIA.	1	1½	1¾	2	2½	2¾	3¾	4¾	5¾	6¾	7⅞
CYLINDER O.D.	1⅞	2⅜	2⅝	2⅞	3½	3⅞	4⅞	5⅞	6⅞	8	9¼
DISPL'CM'T	.003	.008	.010	.014	.021	.026	.048	.077	.112	.155	.210
EFF. AREA	0.8	1.8	2.4	3.1	4.9	5.9	11.0	17 7	26.0	35.8	48.7

TELESCOPIC

SLEEVE DIAMETER

SLEEVE NO.	CYLINDER O.D. 4⅞	5⅞	6⅞	8	9¼
1ST	3¾	4¾	5¾	6¾	7⅞
2ND	2¾	3¾	4¾	5¾	6¾
3RD		2¾	3¾	4¾	5¾
4TH			2¾	3¾	4¾
5TH				2¾	3¾

DISPLACEMENT

SLEEVE NO.	CYLINDER O.D. 4⅞	5⅞	6⅞	8	9¼
1ST					
2ND	.037	.062	.095	.133	.183
3RD		.050	.079	.115	.159
4TH			.066	.098	.139
5TH				.083	.121

Figures in tables shown in units as follows: diameter—inches, area—square inches capacity—pounds, pressure—lbs. per sq. in. displacement—gallons per inch of stroke

EFFECTIVE AREAS OF SLEEVES

SLEEVE DIAMETER	2¾	3¾	4¾	5¾	6¾	7⅞
EFFECTIVE AREA	5.9	11.0	17.7	26.0	35.8	48.7

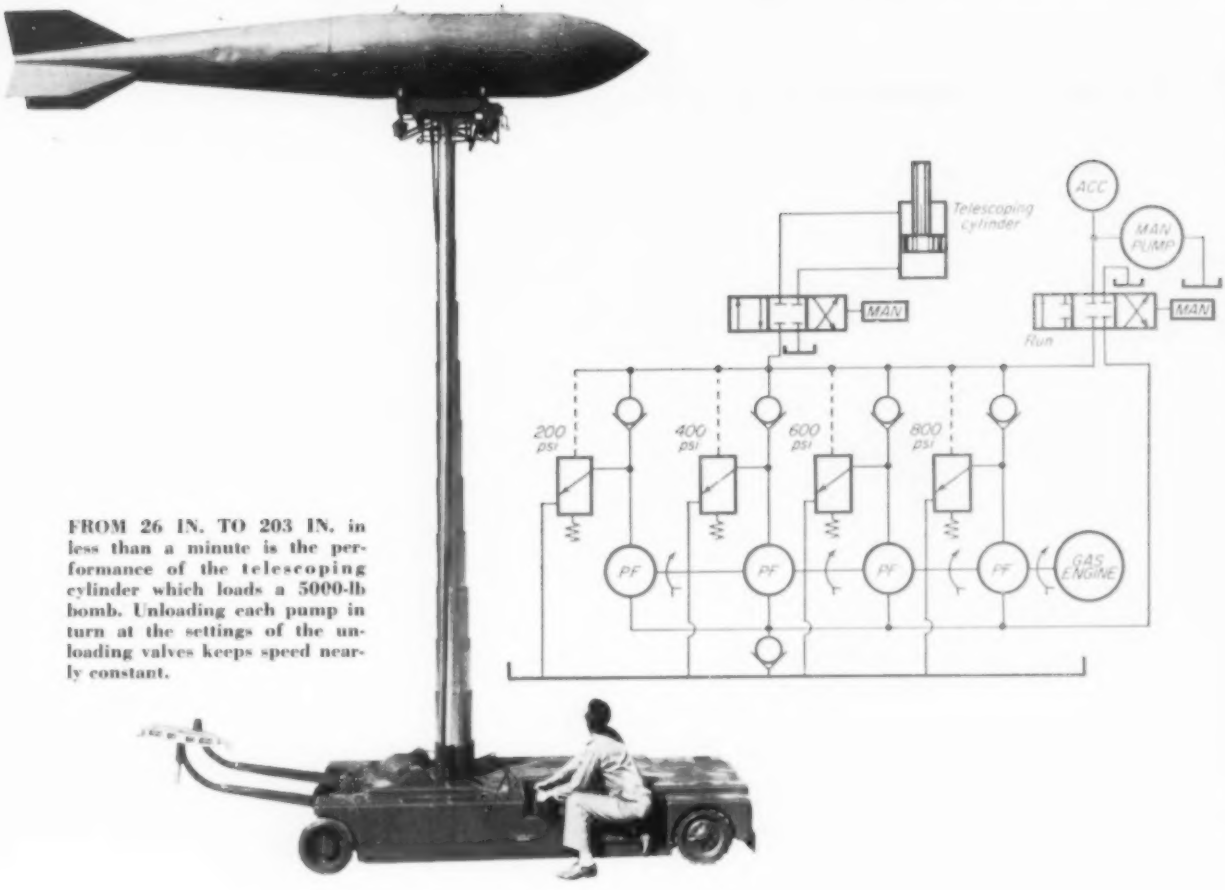
Cylinder capacity, neglecting friction loss, can be approximated by multiplying rod, plunger or sleeve effective area by operating pressure.

Commercial Shearing & Stamping Company

Dept. A-49, Youngstown, Ohio

COMMERCIAL shearing & stamping

CIRCLE 24 ON TIME-SAVER CARD



FROM 26 IN. TO 203 IN. in less than a minute is the performance of the telescoping cylinder which loads a 5000-lb bomb. Unloading each pump in turn at the settings of the unloading valves keeps speed nearly constant.

A disadvantage of telescoping cylinders is that with constant input flow, speed and horsepower requirements increase as the cylinder extends. Designers of this aircraft bomb-lift truck got constant speed and constant horsepower with a 4-pump circuit.

Constant speed for a telescoping cylinder

• By Harry S. Mankey, *Chief Design Engineer, Standard Mfg. Co., Inc., Dallas, Texas*

LOADING a 5000-lb aircraft bomb is a job of careful handling with very compact equipment. The lift truck has to be low enough to maneuver under the airplane, yet it must be able to lift the bomb about 15 ft. In developing their truck, engineers at Standard Manufacturing Co. designed an 11-stage telescoping lift cylinder which extends from 26 in. to 203 in. Because the large sections of the cylinder are about 10-in. diameter compared to the small sections of about 5-in. diameter, speed as well as horsepower requirement at the end of the extend stroke would be increased four times with constant flow. The difference in diameters also makes pressure increase four times. The circuit design for the lift truck takes advantage of this to keep speed and horsepower requirements constant.

• **Circuit Design**—Four, constant displacement, piston pumps connected in parallel deliver through check valves to a common pressure manifold which supplies

NEW·NEW·NEW!

VICKERS "high performance" vane pump

• high speed • high pressure • high efficiency • high service life

NEW COMPACT DESIGN . . . much more horsepower than previous pumps of the same package size.

NEW VANE CONSTRUCTION . . . positive vane tracking at all speeds assures efficient operation at increased speeds and pressures.

NEW SIZES not previously available . . . answers mobile equipment designers' need for greater hydraulic horsepower in limited space.

NEW PARTS INTERCHANGEABILITY . . . many common parts for single and double pumps (two pumps on the same shaft in one envelope). Lessens inventory requirements.

NEW 4-BOLT SAE FLANGE CONNECTIONS . . . will also accommodate user's 2-bolt flanges of the proper design.

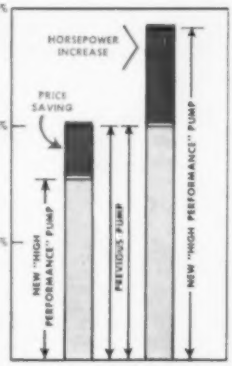
NEW 2-BOLT MOUNTING (SAE 1959 STD.).

NEW REPLACEABLE PUMPING CARTRIDGE . . . all wearing parts of pump are incorporated in one replaceable cartridge. Easy field replacement without removing pump from its mount. Cartridges available in kit form.

MORE HORSEPOWER PER DOLLAR

The graph at right makes a comparison between the new Series 35 "High Performance" Pump and a previous pump of the same delivery capacity. Note the substantial increase in maximum horsepower...over 40%! This power increase is accompanied by a price saving and by a package size reduction of almost one third!

This is the second unit released in the new complete line of "High Performance" Pumps (both single and double). The first (Series 25) is available in 12, 14, and 17 gpm sizes (at SAE rating of 1200 rpm and 100 psi). The three sizes offered in the new Series 35 pump are 21, 25, and 30 gpm. Characteristics are given in table.



Model Number †	Delivery-GPM 1200 RPM 100 PSI	Delivery-GPM 2000 RPM 2000 PSI	Input Horsepower @ 2000 RPM 2000 PSI	Package Size†	Weight
2V21A-**10	20.6	32.1	42.4	L. 6 15/16" W. 5½" H. 6"	50 Lb.
2V25A-**10	24.5	38.0	49.8		
2V30A-**10	29.5	46.8	59.5		

†Exclusive of Shaft Extension and Mounting Lobes

8145

Write for new illustrated Bulletin No. M5108 for further details and performance characteristics.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CIRCLE 103 ON TIME-SAVER CARD

New Miniature SOLENOID VALVES

Available in two- and three-way normally open and closed types, this new line of solenoid valves has a pressure range from 0 to 400 psi.

OUTSTANDING FEATURES:

- Body and all internal parts corrosion resistant stainless steel.
- Soft synthetic plunger insert to prevent leakage.
- Spring loaded plunger permits valve to be used in any position.
- Leakproof welded joints.
- Coils available for practically any voltage requirement.
- Coil housing—steel with heavy bright cadmium plating.
- Can be serviced without removal from media lines.
- Ingenious magnetic structure permits greater media flow and higher pressure ratings than comparable size valves.
- Small in size (1½" x 2¼")—large in capacity.
- Packless—only 2 moving parts.

* FOR MORE INFORMATION WRITE FOR BULLETIN V.

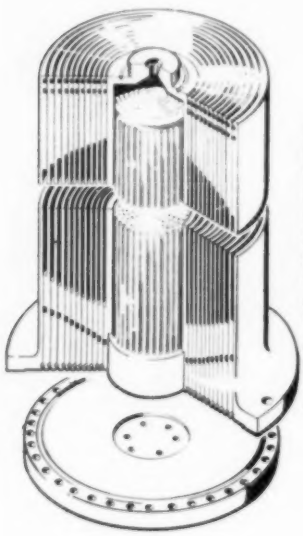
ALLIED CONTROL VALVE DIVISION
ALLIED CONTROL COMPANY, INC.
2 EAST END AVENUE, NEW YORK 21, N. Y.

AS-168

CIRCLE 4 ON TIME-SAVER CARD

the telescoping cylinder. Unloading valves connected to the pumps are set at 200-psi increments from 200 psi to 800 psi. Since these unloading valves are piloted by pressure on the cylinder, the pumps unload in order as the cylinder extends and pressure rises. As each unloading valve opens, and dumps its pump delivery, flow to the cylinder decreases keeping the cylinder speed essentially contant through its full stroke.

Although a more constant speed could be obtained with a variable volume pump which could be stroked continuously, as the cylinder extended, the four fixed displacement pumps are cheaper. The speed control with this arrangement is adequate.



ELEVEN-STAGE, DOUBLE-ACTING TELESCOPING CYLINDER has built-in torque tube to prevent rotation of bomb. Torque tube is made up of splined telescoping sleeves. Cylinder is protected from weather by precision ground, hard chrome outside surface and by wiper strips at upper end of each sleeve.

• **Hydraulic Starting**—A 65-hp gasoline engine powers the truck and drives the pumps. Because the equipment must operate at temperatures of —65 F, a battery cannot be used for starting the engine, so a 2-gal accumulator is connected to drive the pumps as motors to start the engine. A 3-position, 3-way, rotary valve, modified from a 4-way, controls flow to and from the accumulator. In the RUN position, the valve ports fluid to charge the accumulator from the pressure manifold. In the START position, the valve directs flow from the accumulator to motor the pumps. A lightly loaded check valve in the pump inlet line prevents the accumulator charge from dumping into the reservoir.

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CIRCLE 63 ⟶

Miller

FLUID PRESSURE BOOSTERS

BOOST 80 PSI AIR

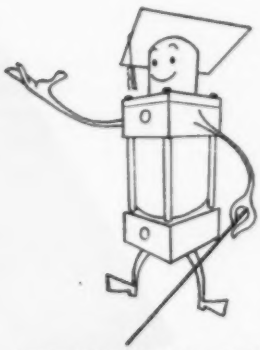
Input Range: 40 to 3000 psi Air or Fluid

TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid

- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- Hold pressure indefinitely without the motion and heat generation of ordinary pump circuits
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute

NOTE: In addition to its most complete line of "Custom-Built" Boosters available on normal delivery, Miller offers 5" bore 25 to 1 ratio boosters for immediate delivery in either 6" or 12" stroke. Write for data and prices.



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- Ingenious magnetic structure permits greater media flow and higher pressure ratings than comparable size valves.
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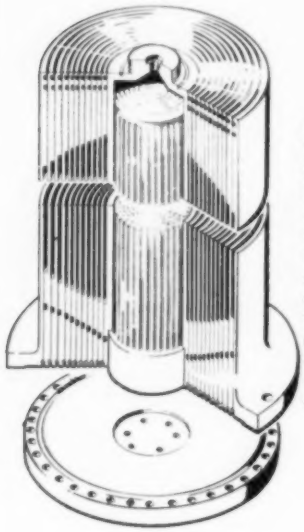
TELESCOPING CYLINDER

the telescoping cylinder. Unloading valves connected to the pumps are set at 200-psi increments from 200 psi to 800 psi. Since these unloading valves are piloted by pressure on the cylinder, the pumps unload in order as the cylinder extends and pressure rises. As each unloading valve opens, and dumps its pump delivery, flow to the cylinder decreases keeping the cylinder speed essentially contant through its full stroke.

Although a more constant speed could be obtained with a variable volume pump which could be stroked continuously, as the cylinder extended, the four fixed displacement pumps are cheaper. The speed control with this arrangement is adequate.



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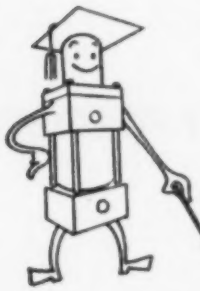
CIRCLE 63 →

COUNTERBALANCE CYLINDERS

Miller

FLUID PRESSURE BOOSTERS



BOOST 80 PSI AIR

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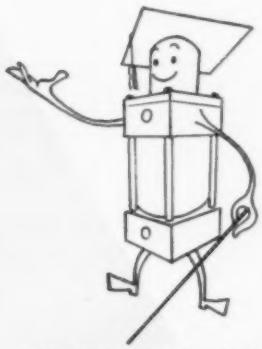

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COUNTERBALANCE CYLINDERS

Electro-mechanical system for preset

• By Leroy A. Morris, *Presho, S. Dakota*

MOST schemes for limiting piston travel in a hydraulic cylinder cannot be quickly overridden when you want some other piston travel. For instance, when mechanical stops or limit switches are used to stop the piston at a particular point or points, going beyond these points would mean unbolting the mechanical stops or using additional electrical circuitry to bypass the limit switches.

Where this change in cylinder stroke is a matter of machine setup, it's no problem. But, when it might be needed at less than 15 minute intervals, the time needed would be a real nuisance. An example of this sort of application is the cylinder which controls plow blade depth on an agricultural tractor. Here, each time the operator starts a new furrow, he may need to extend the plow cylinder beyond the normal working depth because of hard ground or other reason, but then it must be brought back up to normal depth.

For this kind of operation, it's obviously not practical to remove a mechanical stop every time. The system described here will limit cylinder stroke to some preset point for both directions of travel, and lets the operator instantly move the piston as far beyond the stop pin as he wants to within the cylinder itself.

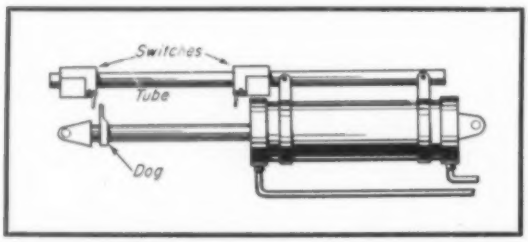


FIG. 1. A TUBE ATTACHED to a double-acting hydraulic cylinder has two positioning switches attached to it. Set screws clamp the switches to the tube and let them be moved to other positions easily. The switches may be operated by the dog in either direction.

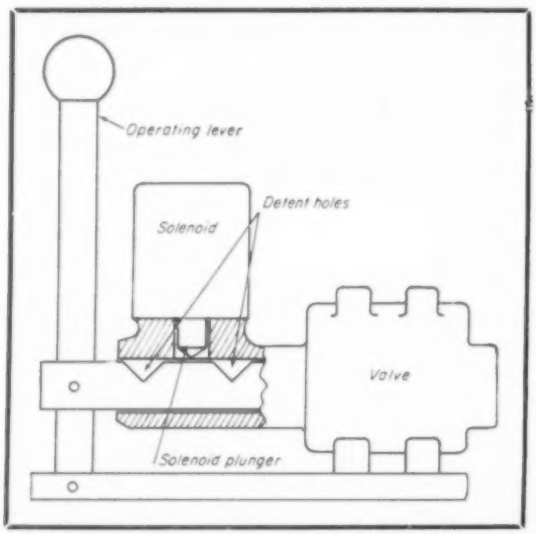
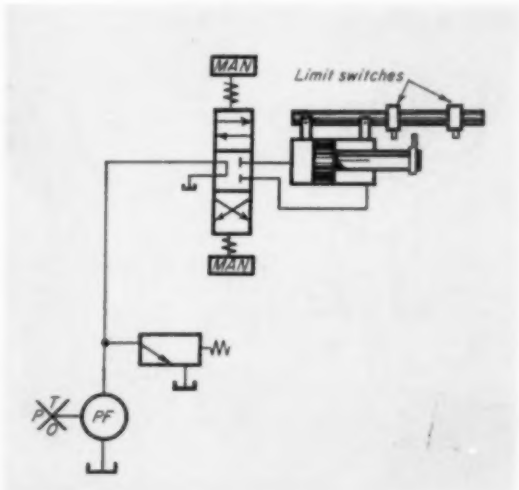


FIG. 2. A SOLENOID PLUNGER is a detent pin for a spring-centered, 3-position, 4-way valve. The operator may move the valve plunger from the detent positions any time by applying enough force to overcome the spring holding the plunger in the indentation in the valve spool shifting link.

• **How It Works**—A tube mounted on an ordinary double-acting cylinder supports two switches which are positioned to establish the stroke limits, Figure 1. A dog mounted on the piston rod contacts the switches when the rod moves to that point. The switches energize a solenoid whose plunger acts as a detent on the spool of a 3-position, 4-way, tandem-center valve, Figure 2. Energization of the solenoid lets the valve spool be



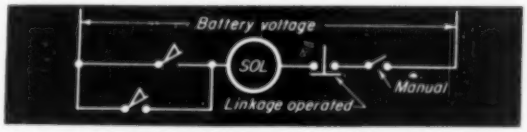


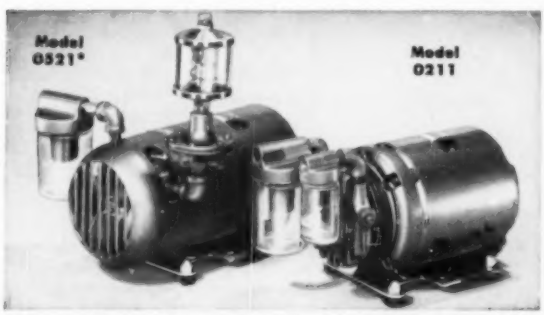
FIG. 3. THE ELECTRICAL CIRCUIT includes two switches other than those mounted on the tube attached to the cylinder.

cylinder stroke

spring centered in the off position. Thus, even though the valve has centered to stop the piston, the operator may extend the rod beyond this point simply by shifting the valve handle.

The cylinder may be stopped or reversed by the operator at any time by moving the valve control handle to the position wanted. It doesn't matter what's happening, all he has to do is overcome the spring behind the solenoid plunger. Because the limit switches may be actuated by the dog on the piston rod whether the piston rod is extending or retracting, the rod will stop at the set position after it has been extended beyond it.

Beside the two positioning switches, there are two other switches in the electrical circuit, Figure 3. One is operated by the control linkage to the valve when it returns to neutral. It breaks the circuit to the positioning switches so there is no electric power drain. The other is a manually-operated switch to let the operator disconnect the system for purely manual operation. ▼▼▼



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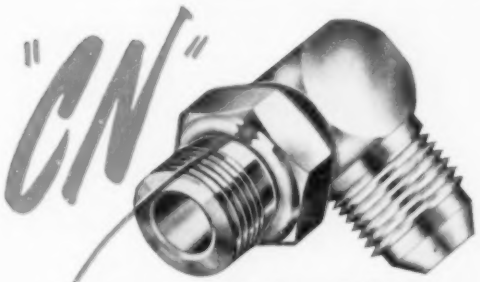

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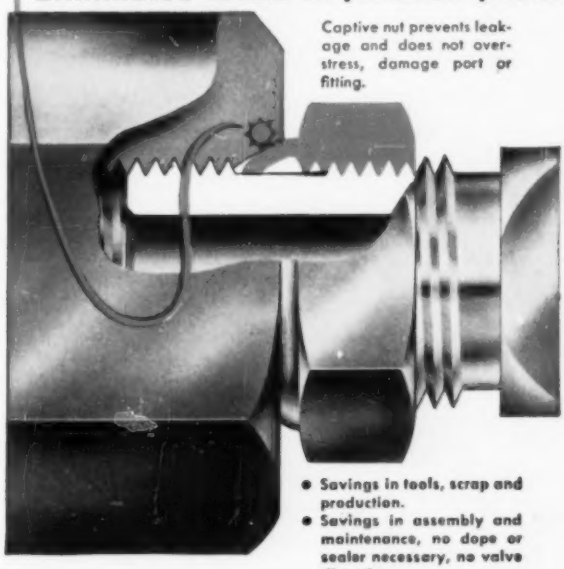

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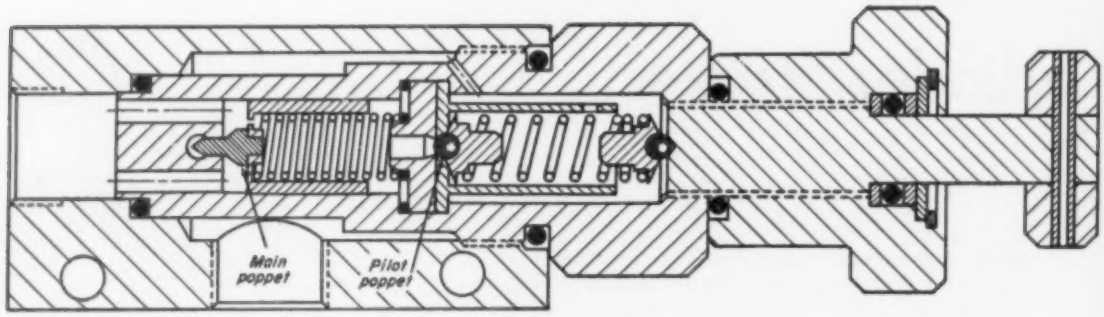
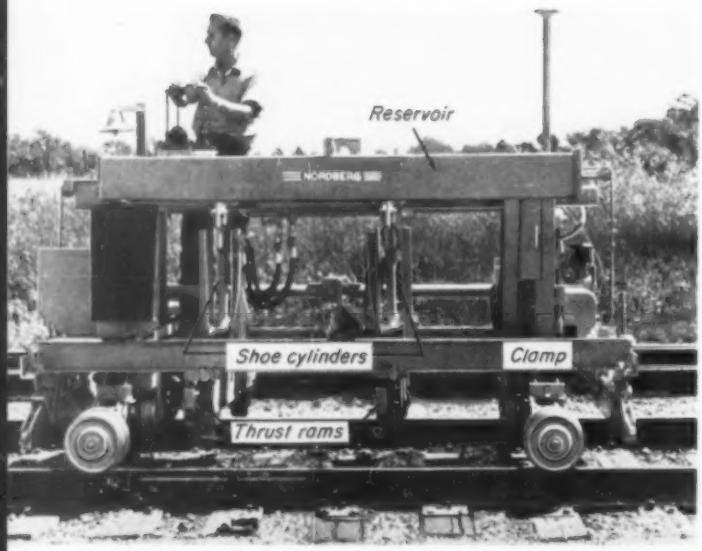


Adjustable relief valve regulates

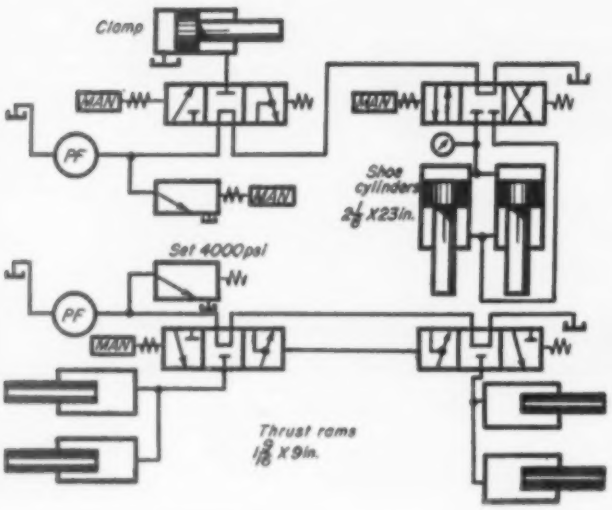
• By E. M. Sheperd, *Chief Engineer, Railway Equipment Div., Nordberg Mfg. Co.,*

and Hugh T. McGee, *Dynex, Inc.*

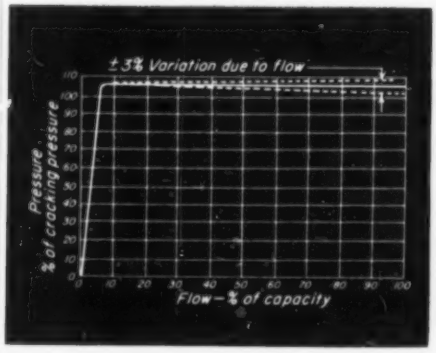
It's easier to move railroad tracks sideways (lining) when you lift them. But if you lift too far, you'll hump the track. An easily adjustable relief valve on Nordberg's Trakliner presets the lifting force for any track condition.



OPERATOR CONTROLS Trakliner's functions with three poppet type manual valves mounted in a bank. Hydraulically balanced design makes operation easy even at high pressures. Valves are rated for 6000 psi. Throttling design permits controlling the load from creep to full speed. Two top horizontal box sections of the frame form hydraulic reservoirs of 8.4 gal each. Relief valve is mounted with control valves.



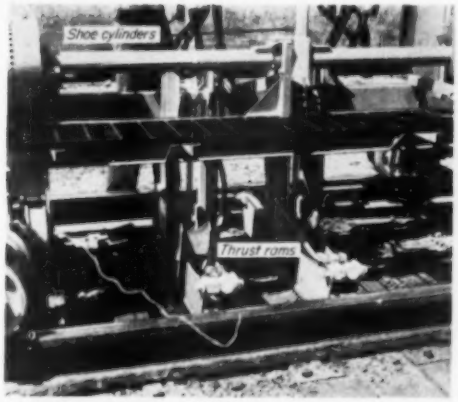
THREE-WAY, THREE-POSITION VALVE SECTIONS make up the valves for the machine. Two are connected together and operated with one handle to make the 4-way valve controlling the double acting shoe cylinders. Two others are connected separately but operated together to control either set of single-acting thrust rams. Axial piston pumps are rated at 3000 psi continuous, 5000 psi intermittent. Displacement is .810 cu. in./rev. giving a delivery of 3.9 gpm at 1200 rpm and 5.7 gpm at 1800 rpm. Maximum speed is 2200 rpm. These check-valve type, piston pumps operate at low noise level, with overall efficiencies to 90%.



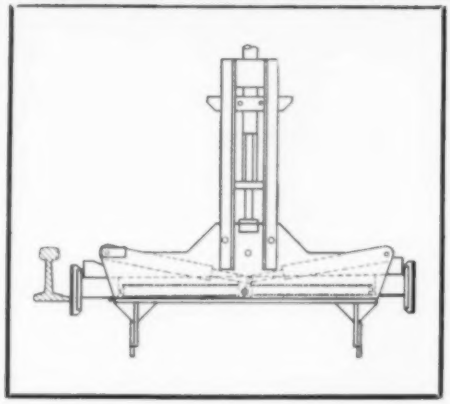
PILOT-OPERATED RELIEF VALVE maintains constant system pressure within 3% at flows from about 6% to 100% capacity. Main valve is responsive only to flow through pilot valve and positions itself to maintain constant pilot flow. Any change in pressure at the pressure port affects pilot flow which in turn controls main valve.

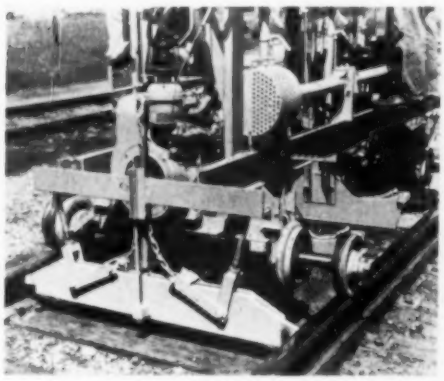
Courtesy Fluid Controls, Inc.

pull



WITH SHOE CYLINDERS EXTENDED to lift track, ties, and machine, thrust rams are actuated to exert 5000 lb to push track sideways. Throw may be as much as 2½ in., can be controlled down to 1/32 in. Single-acting thrust rams are returned by springs and mounted as shown for compactness. Their pistons are sealed against the cylinder by two O-rings with backups. A third O-ring seals the bolted-on piston against the rod.





SPRING-LOADED CLAMPS at each end are raised through cables pulled by the horizontal CLAMP cylinder (not shown) that also retracts the clamps. Two-cylinder, 16.4-hp engine drives the machine and the pumps (shown above the engine) through chains. Tension on the pump-drive chain is maintained by a screw which adjusts pump position.

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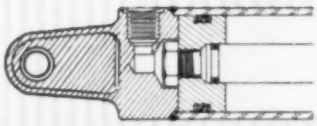

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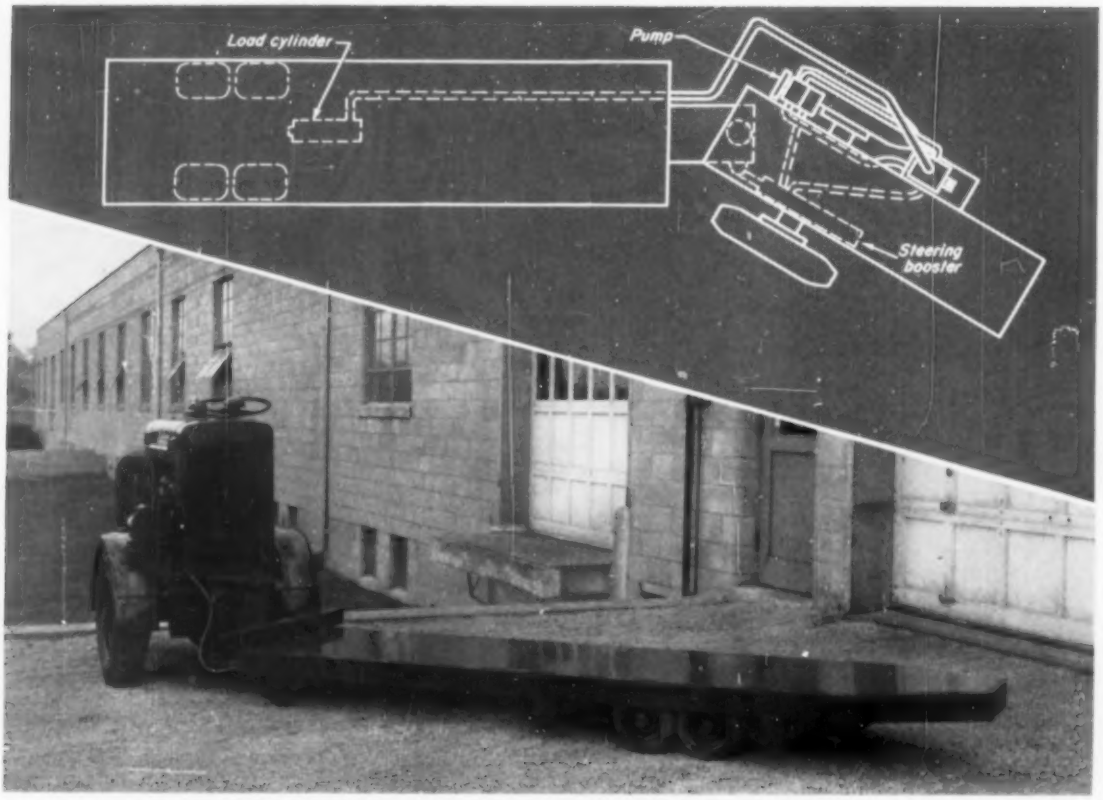
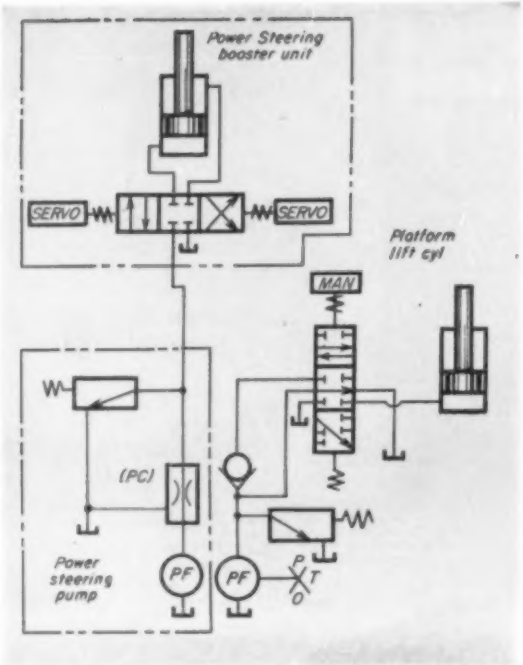


FIG. 1. ARTICULATION AND HYDRAULIC POWER STEERING make this platform truck very maneuverable. Sketch shows how the booster cylinder, which is mounted on the power unit, is connected to the platform.

Flow control valve smooths steering booster performance

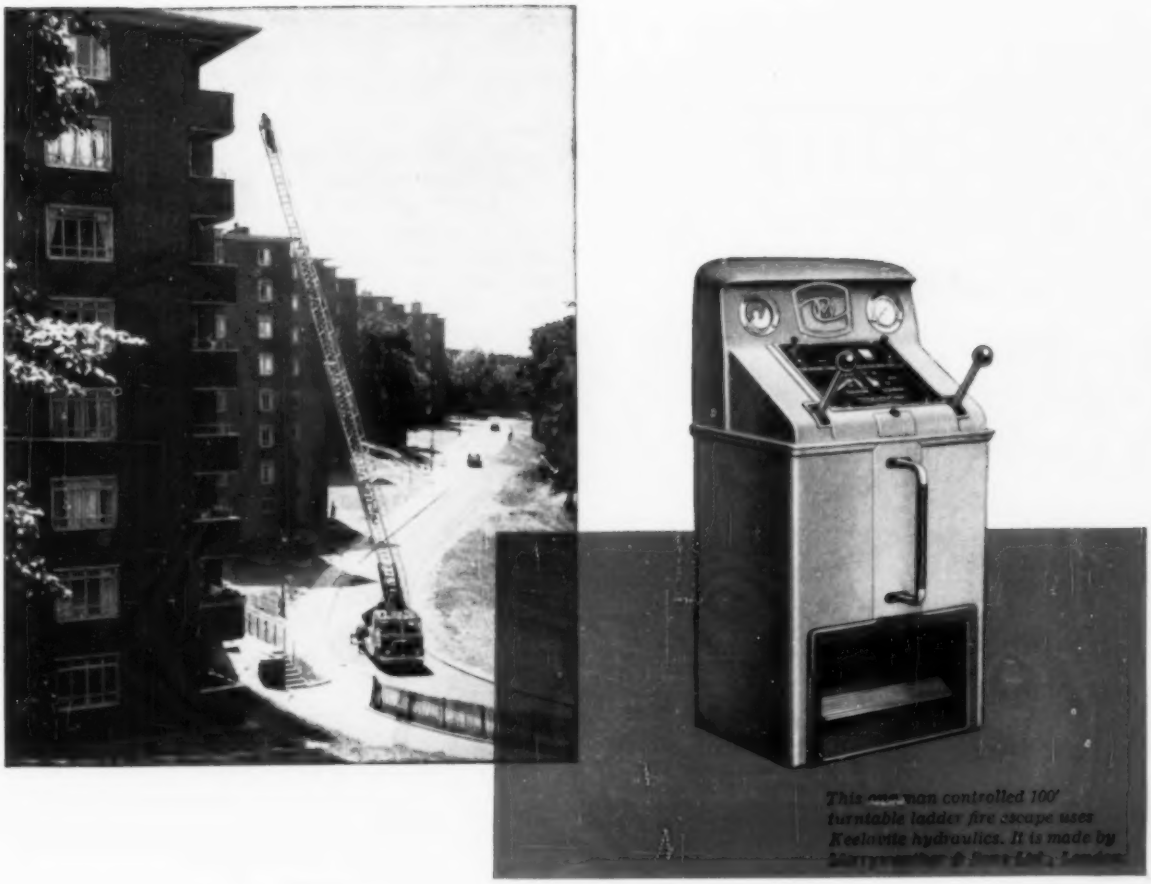


MANEUVERABILITY of an articulated platform truck built by Erickson Power Lift Trucks Inc. of Minneapolis, Minnesota is far better than for one-piece trucks of equal overall length. The platform is pinned to the power and driving unit. A hydraulic power-steering unit connects the two assemblies and steers the truck by shifting the angle of the power unit with respect to the platform, Figure 1. The truck is 12 ft long and can be turned in a 9 ft 6 in. radius.

• **Hydraulic Circuit**—Output of the engine-driven, hydraulic, power-steering pump must be kept nearly constant, even though engine speed may vary from 500 to nearly 4000 rpm. Without a regulator, pump flow would vary directly with speed and so would the response of the steering.

The circuit diagram, Figure 2, shows how they keep

FIG. 2. HYDRAULIC CIRCUIT DIAGRAM for the articulated platform truck.



This one-man controlled 100' turntable ladder fire escape uses Keelavite hydraulics. It is made by [illegible]

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MECHANICAL HANDLING DIVISION

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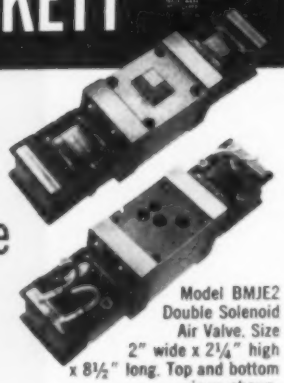
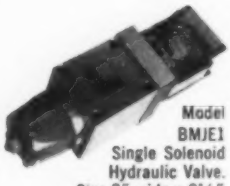
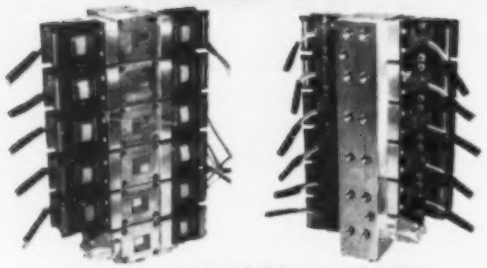

Model BMJE2 Double Solenoid Air Valve. Size 2" wide x 2¼" high x 8½" long. Top and bottom views shown.

Model BMJE1 Single Solenoid Hydraulic Valve. Size 2" wide x 2¼" high x 7¼" long.
Provide extremely compact multiple valve installation with common subplate for automation controls on specialized machine tools and other production equipment.

Typical six valve installation—top and bottom views shown. Block is 12½" long.
- Valves mount on 2" centers.
- Up to 6 units on one manifold.
- Two, three or four way.
- All spool types available.
- Special spools to specifications.
- Solenoid, pilot or manual control.
- Nominal ¼" size

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CIRCLE 14 ON TIME-SAVER CARD

FLOW CONTROL VALVE

pump output nearly constant. A fixed-setting, pressure-compensated, flow-control valve regulates flow as shown in Figure 3. The pump, flow-control valve, and relief valve in the power-steering circuit are a unit as the circuit diagram shows. So are the booster cylinder and the steering servo valve. This greatly simplifies installation and connection. Figure 4 is a cutaway of the pump body showing construction of the relief and flow control valves.

In addition, hydraulics raises the platform. The single-acting cylinder retracts by the weight of the load when it is ported to the tank. The control valve ports oil to the tank and unloads the pump except when the cylinder is being raised. ▼▼▼

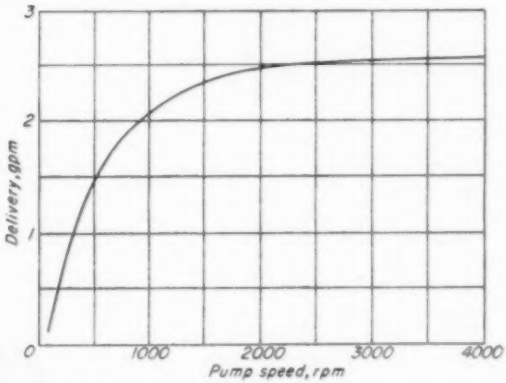


FIG. 3. NEARLY CONSTANT DELIVERY over a wide speed range is given by the flow control valve. Actual pump capacity is far above delivery at higher speeds.

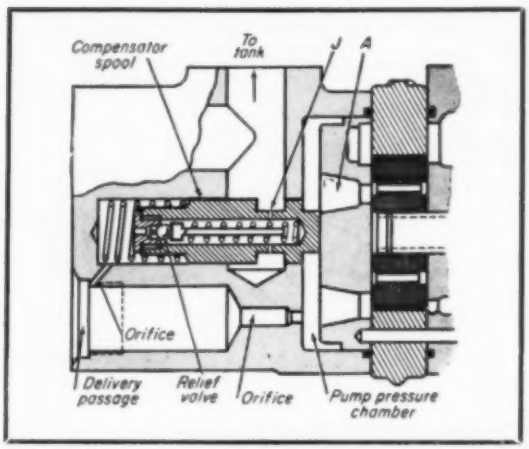
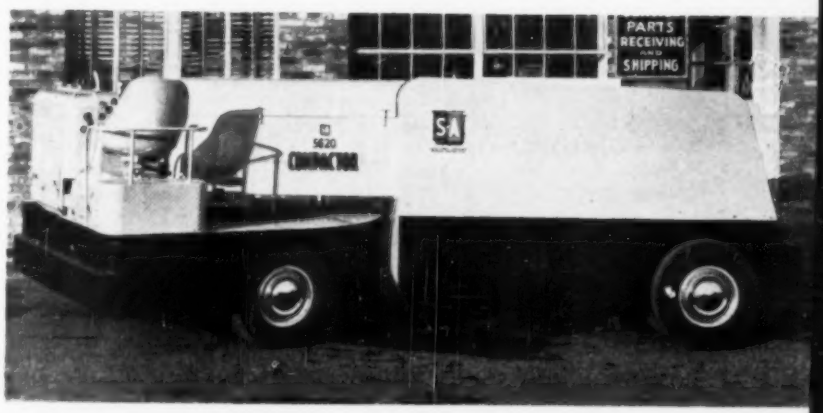


FIG. 4. CUTAWAY OF THE PUMP BODY shows integral flow-control and relief valves. Compensator spool position depends on pump outlet pressure and pressure at the outlet end of the delivery passage. As flow through the orifice at the upstream end of the delivery passage increases, the pressure drop across the orifice reduces pressure to the left end of the compensator spool though the orifice at the exit port. This makes the spool move farther to the left to bypass more of pump output to the tank passage and tank.

Courtesy Vickers, Inc.

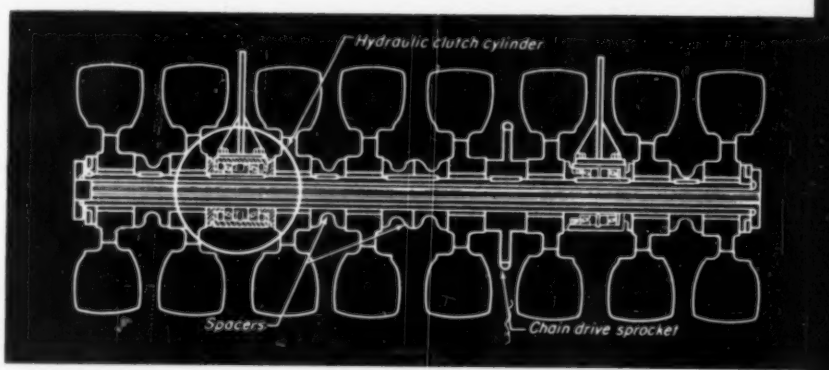
Multi-wheeled compactor is controlled by hydraulic brakes, clutches

• By Russell W. Henke, *Chief Engineer, Seaman-Andwall Corp., Milwaukee, Wis.**



THIS ARTICULATED COMPACTOR has wagon steering (the steering axle pivots about a central pin or shaft); therefore, in a turn, wheels at either end of the axle want to turn in opposite directions. Wheels at one end of the axle may actually go backward while those at the other end go forward when the compactor is moving forward slowly.

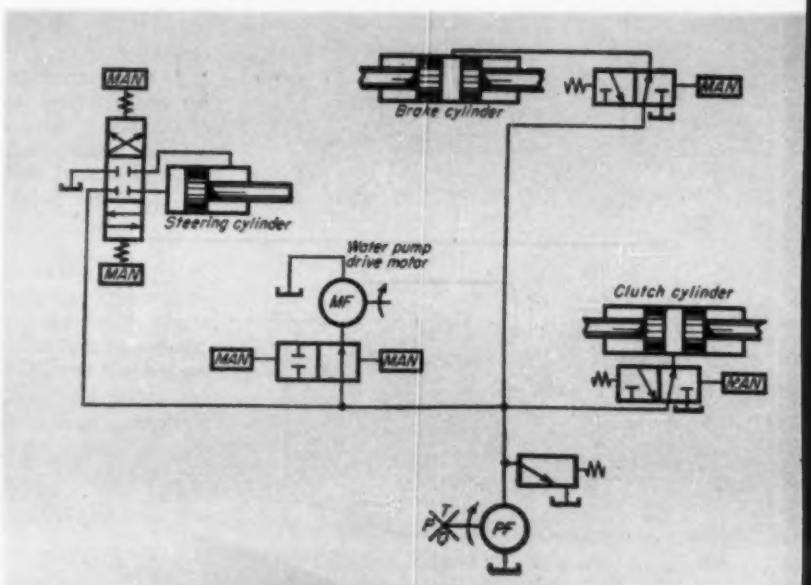
The design was complicated enough because the steered axle is also the drive axle. It was even knottier because the drive axle had 8 wheels.



HYDRAULIC CLUTCHES saved the day. The axle tube is driven by roller chain and sprockets. Spacers between the wheels are keyed to the tube. Clutch facings on the spacers bear against the wheels. One of the main support bearings for the axle tube is also a hydraulic cylinder. Pressure applied to this cylinder forces the spacers and clutch facings against the wheels to drive them.

Releasing pressure lets the wheels slip when rounding curves. A pressure gage calibrated in percent of clutching force tells the operator how he's doing.

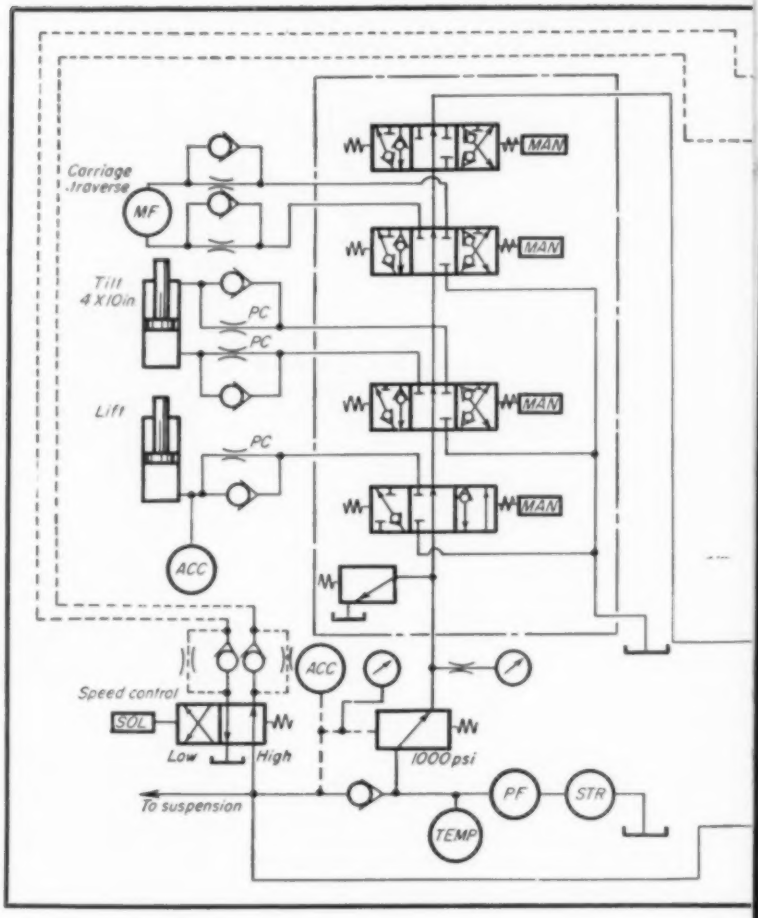
A similar setup on the rear axle brakes the compactor. Here, of course, the axle tube and spacers don't revolve. They only slide axially. Nine wheels are used on the rear axle.



HYDRAULIC CIRCUIT DIAGRAM shows that hydraulics is also used to steer the compactor and drive a water pump. The water pump sprays water through spray bars at the front and rear to keep the dust down. A 12-gpm pump supplies the hydraulic fluid. Relief valve is set at 1200 psi.

**Now, President, Russ Henke & Associates, Elm Grove, Wis.*

Four fluid motors give lift truck series, parallel drive



• By Charles S. Davis, Jr.
Staff Engineer, Bergen Research Engineering Corp., Teterboro, N. J.

and John Sharp
Denison Engineering Div., American Brake Shoe Co., Clark, N. J.

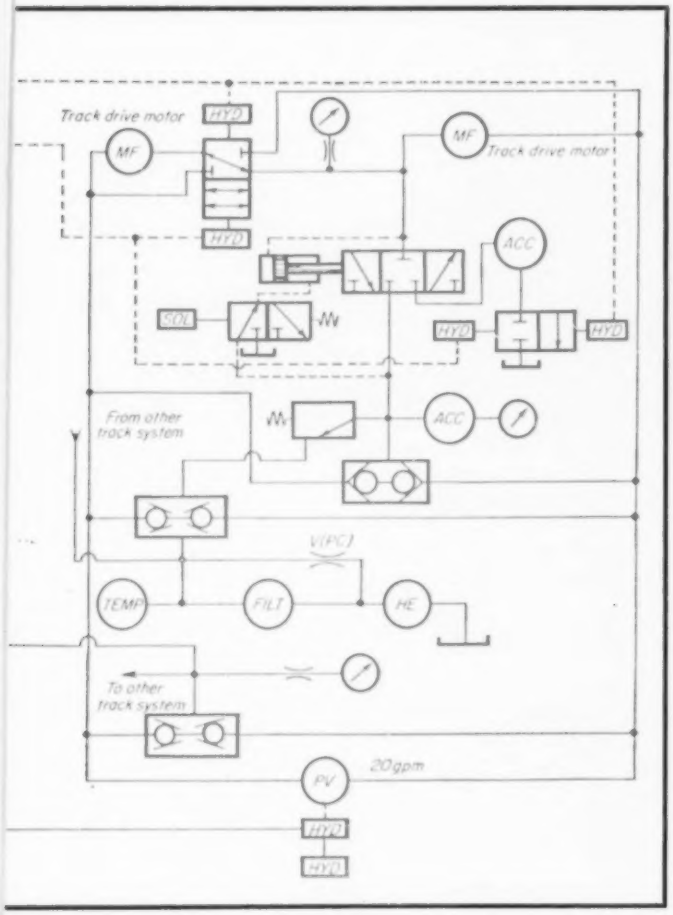
WHEN designers at Bergen Research Engineering got the project of developing a lift tractor for the army, they came up with some ingenious ideas for hydraulically driving it and handling the load. Because the machine had to operate fast over rough terrain, the carriage including the load and operator is shifted back over the tracks from it's overhanging position during loading.

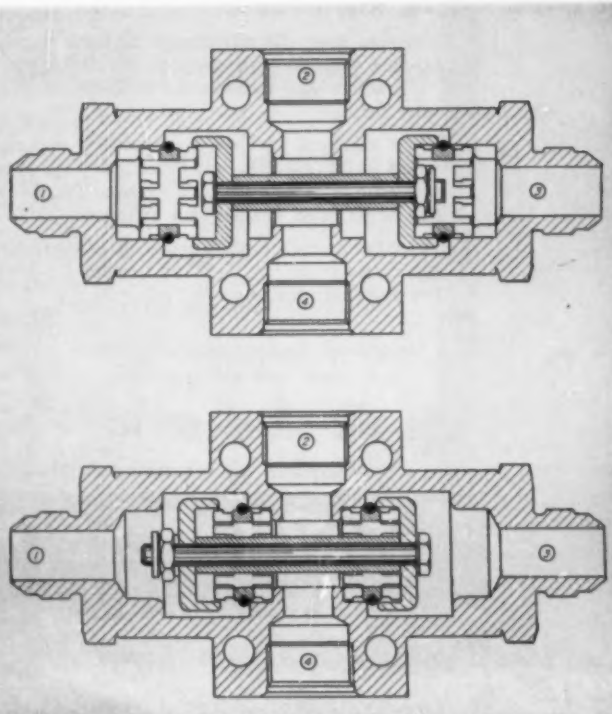
Two fluid motors, which can be connected either in series or parallel for different speed and torque ranges, drive each track. Each set is supplied by a 20-gpm variable delivery, axial piston pump which is controlled by the driver through a master-slave, hydraulic system.

A 15-gpm gear pump supplies the other hydraulic functions of lift and tilt, fluid motor drive for traversing the carriage, and the torsion-bar leveling system. This pump also powers the hydraulic actuator which controls displacement of the piston pump, and it supplies pilot fluid for switching connections of the drive motors. Supplying the axial piston pump control externally like this gives better control at small displacements.

• **Drive System**—The axial piston pump is connected in a closed system with make-up fluid being supplied by the gear pump through open-center porting of the 4-spool valve which controls load handling. Since the pump can deliver from either port, make-up fluid is connected to it through a shuttle valve which is positioned by pump output pressure to connect make-up always to pump inlet.

Porting fluid to the two fluid motors to connect them in either





1 **DRIVE SYSTEM** (in color) shows valving to change fluid motors from series to parallel circuit, and equalizing system to keep same pressure across each motor in series. Fixed displacement pump supplying load handling operations (in black) also supplies make-up fluid to the closed, drive system.

2 **CARRIAGE IS SHOWN FORWARD** with load raised 12 ft. Front end is kept level by cylinder-actuated torsion bars. Valve controlling the cylinder has its stem connected between track suspension and chassis. Heavy damping with a shock absorber prevents the valve from responding to transients or vibration over rough terrain.

3 **STEERING MECHANISM** controls displacement of variable volume pumps supplying each track drive. Joy stick is attached to stub shown at left. Forward and backward motion actuates both master units of master-slave hydraulic system for corresponding speed and direction of the tractor. Diagonal motion of the stick drives one track faster than the other (or puts one in reverse) for turning.

4 **SHUTTLE VALVES** permit reversing fluid motors with closed hydraulic system. In top valve, pressure at port 1 or 3 connects this port to ports 2 and 4. In bottom valve, pressure at port 1 or 3 connects opposite port to ports 2 and 4. Balanced O-ring sealing of these valves is also used in aircraft valves where it gives advantages of light weight, small size, and high flow.

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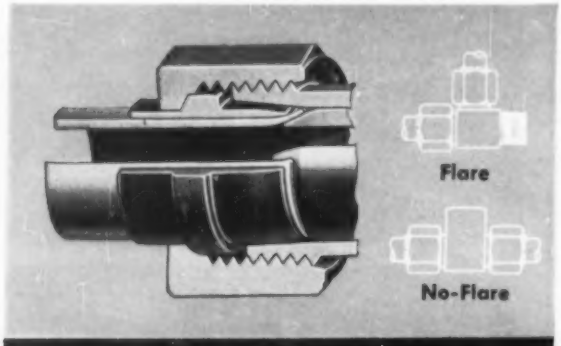

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series or parallel gives two speed—torque ranges. Series connection gives high speed, low torque; parallel connection gives low speed, high torque. Valving the motors to either connection is done by a pilot-operated, 4-way valve with porting as shown on the circuit diagram. Pilot fluid to this valve is controlled by a 4-way valve operated by a 24-volt, d-c solenoid. Flow controls in the pilot lines regulate shifting of the pilot-operated valve and prevent surge pressures when changing from one motor arrangement to the other.

Pilot fluid is supplied from a 1-gal, piston type accumulator which is kept charged to 1000 psi by the gear pump. A sequence valve set at 1000 psi and piloted from the accumulator prevents the pump from supplying its other functions unless the accumulator is fully charged. Therefore, speed control and steering (by individual speed control of the tracks) have priority over load handling.

• **Motor Loading**—With the fluid motors connected in parallel, they each have equal pressure drop, and therefore share the load equally except for manufacturing differences in slip. However when they are connected in series, some method must be used to equalize pressure drops. In this system, pressures are monitored at the inlet to each motor and applied to the pilot operator of a 3-way, 3-position valve modified from a 4-way.

This pilot operator is actually a small cylinder whose head end area is twice the annular area of the rod end. This valve is teed off from a point between the motors, so that it can either port fluid from the pump to this point or connect the point back to pump inlet.

If pressure drop across each motor is equal, pressure at the inlet to the first motor is twice the pressure at the inlet to the second. With these applied to the corresponding areas of the valve operator, the forces are equal and the valve remains in neutral position, blocking flow from the T-connection between the motors.

When changing from a series to a parallel circuit, pressure at the downstream motor doubles. This unbalances forces on the valve operator, so the valve shifts to make the tank connection. However a pilot-operated 2-way valve (modified from a 4-way) in the tank line closes to block this flow. A 43-cubic inch piston accumulator in this tank line prevents shock from this rapid pressure increase. To increase shifting speed of the 3-way valve, and prevent any overpressure at the second motor when the series circuit is selected, a solenoid-operated 3-way valve drains the head end of the hydraulic operator.

• **Cooling**—Because of the closed circuit of the drive system, part of the return fluid is bled off before going to the pump inlet and directed through a heat exchanger which is supplied with water from the engine cooling system. This fluid is connected through a shuttle valve which is part of the arrangement to permit driving the motors in either direction. ▼▼▼

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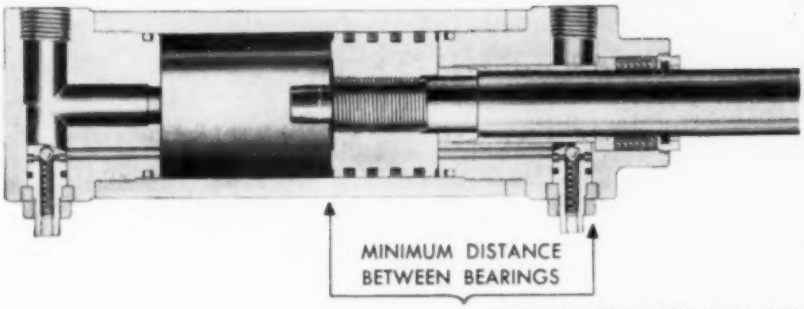

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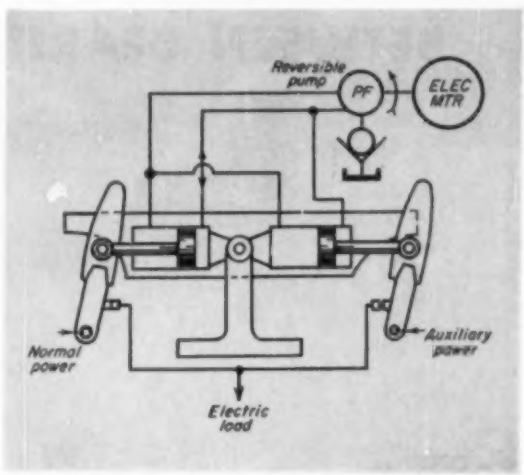
Miniature cylinders trip transfer switch

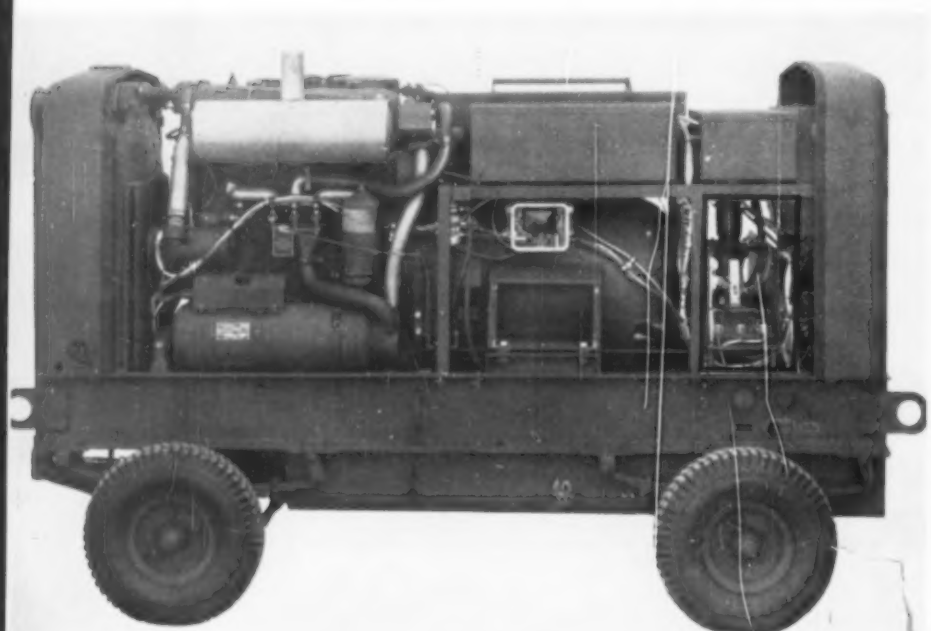
TO AVOID electrical power interruption to field radar equipment, Saylers Equipment Co., Los Angeles, Calif., designed a trailer mounted diesel generator for the Air Force. A hydraulically operated switching mechanism is used to automatically start and cut in the generator if normal power fails.

• **Automatic Transfer Switch**—The patented switching element has two circuit breakers, two double acting cylinders, a mechanical linkage, and a hydraulic pump with reversible motor. Circuit breakers with ratings to 300 amp are mounted opposite each other with the switch lever of each connected to the rod end of a cylinder. Blank ends of the cylinders are bolted together at a bracket between the two circuit breakers. Pressure supply and return flow from the cylinders is controlled by direction of rotation of the pump. The mechanical linkage is mounted above the cylinders and acts as a pawl to prevent either circuit breaker from closing when the other one is closed. Valves, in the pump, control flow to the cylinders and provide a closed circuit hydraulic system.

• **Operation**—If normal external power fails, a circuit is energized which starts the generator, allows it to come up to speed, and then rotates the pump motor clockwise. This actuates the two cylinders, opening the normal power circuit breaker and closing the auxiliary power circuit breaker. The radar equipment will remain on auxiliary power until normal power is restored for a period of time set on the time delay relay. At this time an electrical switch is tripped which causes the pump motor to rotate counter-clockwise, opening the circuit breaker for auxiliary power and closing the one for normal power. The generator will then run in stand-by for five minutes and shut off automatically. ▼▼▼



TWO CYLINDERS operate circuit breakers to switch from normal to auxiliary power. Cam assures that one circuit is open before the other closes.



EMERGENCY GENERATOR set powers a field radar trailer. Unit will automatically take over the load if normal power fails.

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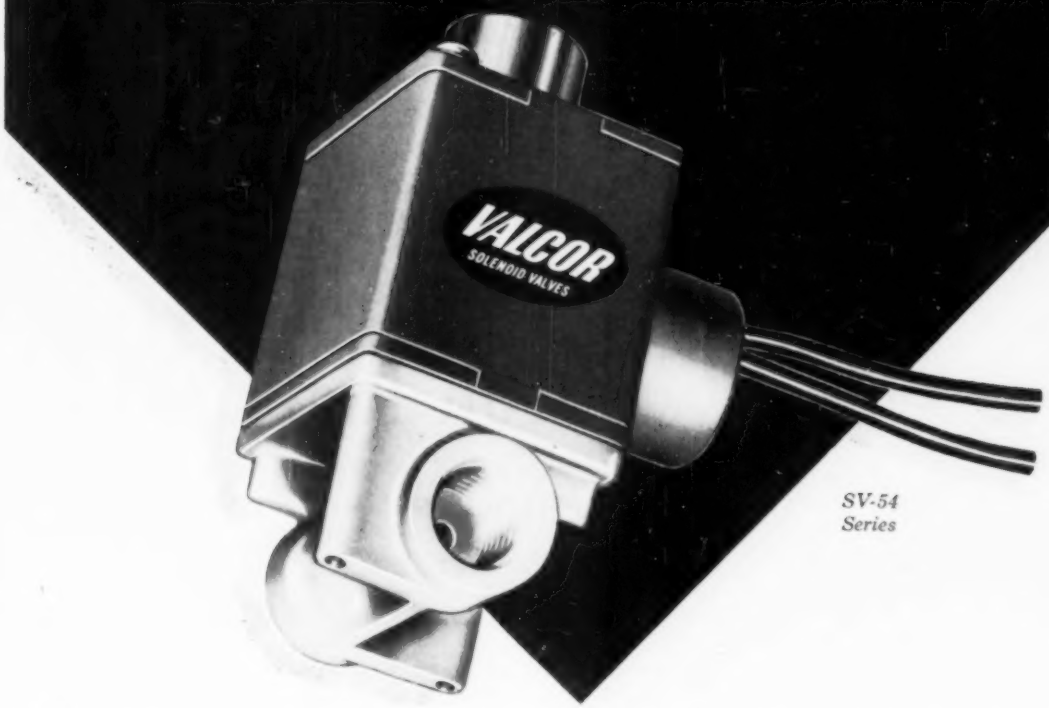

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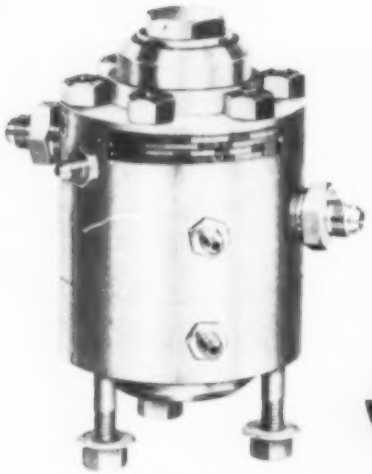

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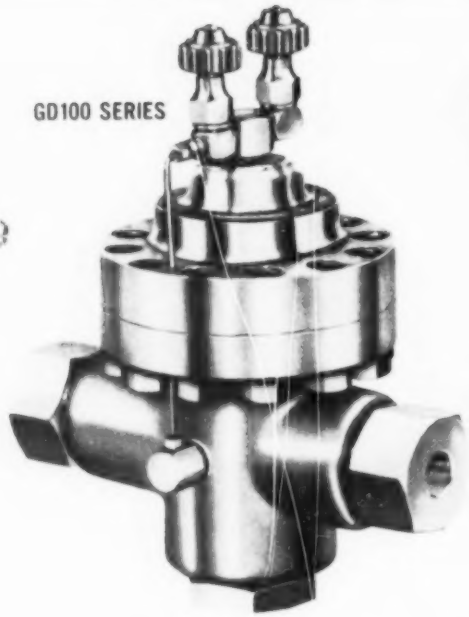

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GD30	2,500	2,500	Load & bleed valve control	25,000
GD31	3,600	3,600	Load & bleed valve control	36,000
GD61C	2,500	2,500	Load & bleed valve control	10,000
GD62C	3,600	3,600	Load & bleed valve control	12,000
GD65	6,000	6,000	Load & bleed valve control	15,000
GD65C	7,000	7,000	Load & bleed valve control	15,000
GD80A	5,000	5,000	Load & bleed valve control	20,000
GD81A	10,000	10,000	Load & bleed valve control	50,000
GD86R	10,000	10,000	For remote control only	75,000
GD100R	6,000	6,000	For remote control only	240,000
GD100	6,000	6,000	Load & bleed valve control	240,000
GD700	7,000	7,000	Single adjustment regulator control; self relieving	15,000
SR10	3,600	1,000	Small, spring loaded regulator	200
LR20B	7,000	7,000	Spring loaded regulator; self relieving	120

Operating temperature range: −67 F. to +250 F.

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DECEMBER 1958

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By William E. Mayhew

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FLUID POWER AT FARNBOROUGH—1958 100
By John A. Lankester

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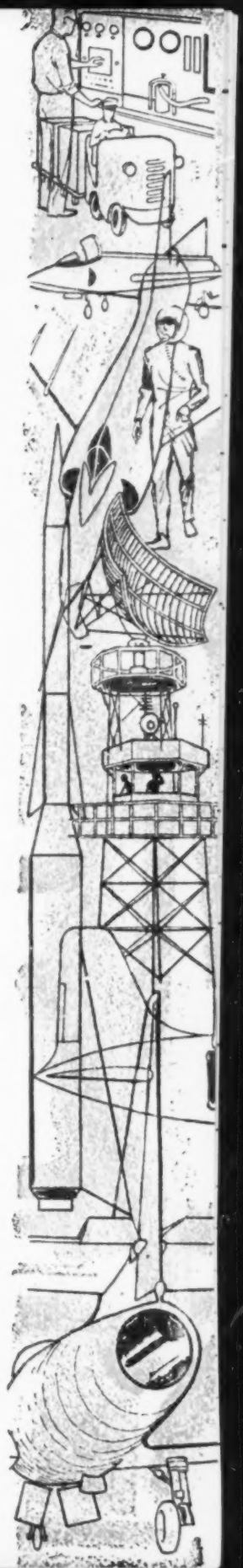

Hydraulic system design for future

• Fluids • Materials • Seals

• By William E. Mayhew, *Design Specialist, Republic Aviation Corp.*

EFFECTS of high operating temperatures on hydraulic fluids, construction materials and sealing materials create most of the problems in designing hydraulic systems for tomorrow's aircraft. These problems are not altogether solved for today's aircraft and the solutions for the even higher temperatures that are coming won't necessarily be found in this article. But, let's take a look at these problems and some of the possible solutions.

• **Fluids**—Probably the biggest obstacle in the way of designing tomorrow's successful high-temperature hydraulic system is a good fluid. The fluid wanted must not only transmit power, it should be thermally stable, lubricate moving parts of the system, have a high bulk modulus throughout the entire temperature range, have a flat viscosity curve and lots of other desirable properties. This is what we want. Now what have we got?

Most of today's airplanes use MIL-O-5606 fluid. This is a petroleum-base fluid which works quite satisfactorily over a temperature range of −65° F to 160° F and can be used to +275° F if air in the system is held to a minimum. Above +275° F, two fluids have been developed and tested. These are Oronite 8515 and OS-45, and are for a range of −65° F to +400° F. Oronite 8515 is the only high-temperature fluid now being used.

A fluid which has been getting attention as a good possibility for the −65° F to 700° F temperature range is chlorophenyl methyl silicone. Though it lacks lubricity and oxidation resistance, it seemed that it might be possible to improve these properties with additives and modification of the base stock. Recent tests show that these thoughts were too optimistic. Beside the failure of numerous pump parts in laboratory tests, bulk modulus at high temperatures is too low.

Development of silicone fluids has not been abandoned, but more work is now being done with silphenylenes. These are an outgrowth of work on silicones. They are thermally stable at temperatures above 800° F and are usable down to +20° F. Like the silicones, they lack lubricity.

Napthenic-type mineral oils may be usable at temperatures of +32° F to +700° F. Exact length of time for which they are thermally stable at 700° F is not yet known. It's estimated they may hold up for 20 hours. Tests show that some decomposition occurs after 6 hours at 750° F but there are no residual decomposition products. They are mostly small and volatile.

Alkyl diphenyl ethers may be useful for a temperature range of +20° F to 600° F for about 20 hours. One base stock has good stability in 20-hour tests at 600° F and 6-hour tests at 700° F. In 20-hour tests, decomposition is moderate at 650° F and heavy at 700° F. A proprietary ester compound with a liquid range of −85° F to +700° F is reported stable at 600° F, but life at this temperature is not yet certain. There is hope that an alkyl aromatic ether with better properties may be found.

Three other classes of fluids—polyaromatic ethers, polyaromatics, and aryl silanes—have good thermal stability at temperatures of 700° F and higher. These fluids are all quite recent developments and it's really not known yet whether they'll be good high-temperature fluids. They can't be formulated for temperatures below +20° F without hurting high-temperature properties and they don't seem to have good lubricity at high temperatures.

From all the facts on the most promising of these fluids, it's easy to see that their lubricity, viscosity at high temperatures, and thermal stability aren't going to simplify high-temperature hydraulic system design. Contamination from fluid breakdown at high temperatures may be a very serious problem. Even now, with systems operating at much lower temperatures than those to come, contamination is a problem.

• **Materials**—Fluid properties as well as high temperatures affect material selection for high-temperature hydraulic systems. Strength at high temperatures, low coefficients of thermal expansion, high-temperature hardness, and oxidation resistance are needed because of high temperatures and the wide temperature range. Good wear and gall resistance, and self-lubricating properties are needed because of fluid shortcomings.

Table I lists some of the more promising materials for high-temperature systems and their important characteristics. The cobalt-base alloys come closest to being the ideal bearing materials because: they have good resistance to wear and corrosion under oxidizing conditions; are inherently hard, retain much of this hardness at red heat temperatures, and recover their original hardness when cooled; they have low coefficient of friction and need little or no lubrication. A spherical rod-end bearing of a cobalt alloy for 1000° F operation and 500 hours life has been made by one manufacturer. Inner

and outer races are of the same material to prevent galling and seizing, and give equal thermal expansion. The ball is electrolized; the outer race is coated with another material.

Surface treatments like Electrolyzing, flame plating, or dry lubrication have been successful in preventing galling and seizing in tests at 1000° F. Some material-surface treatment combinations which test satisfactorily are:

1. Carpenter VSM piston rod, Electrolyzed, in sliding contact with an untreated gland of the same material at 850°F.
2. Inconel-X with Electrofilm #2006 against a block of Haynes #25 alloy.
3. Inconel-X flame plated with LA-2 against Haynes #25 alloy.

A mixture of cadmium oxide and graphite has been reported to be an effective lubricant for cast Inconel sliding against Inconel-X from room temperature to 1000° F. Materials coated with the same material do not work well in sliding contact.

The alloys 19-9DL, 19-9DX, and S-590 are good for bolts because they are relatively notch insensitive. These alloys are recommended for bolting parts made from austenitic stainless steels like 18-8 because coefficients of thermal expansion are about the same. Seizing of nuts on bolts can be prevented by using different alloys for each. For instance, a 19-9DX bolt should have an S-590 nut.

Resistance to relaxation at 1000° F is the reason Inconel-X, A-286, and S-816 are recommended for springs. Inconel-X is also being tested for tubing, piston rods, glands, and cylinders for 1000° F service. Another high-temperature tubing material is Croloy 15-15N. It has greater

TABLE 1—HIGH-TEMPERATURE HYDRAULIC SYSTEM MATERIAL PROPERTIES

USE AND MATERIAL DESIGNATION	PRINCIPAL ALLOYING ELEMENTS	RUPTURE STRESS AFTER 1000 HR @ 1200 F (PSI)	CONTINUOUS OXIDATION RESISTANCE TEMPERATURE (°F)	HARDNESS	COEFFICIENT OF THERMAL EXPANSION (IN./IN./°F x 10^{-6})
PISTON RODS					
A-286	26% Ni, 15% Cr	61,000	1800	95.4 R_B @ 1000F	9.9
Inconel-X	73% Ni, 15% Cr	80,000	1500+	260-300 BHN @ 1200F	9.0
Carpenter V. S. M.	5% Mo, 3% Cr	——	——	307 BHN @1000F	7.44
Haynes #25	20% Cr 15% W 10% Ni	67,000	1900	125-130 BHN @ 1200F	8.55
ROLLER BEARINGS					
Bower 315	5% Mo, 3% Ni, 1.5% Cr	——	——	45 R_C @ 1000F	——
G. E. J-1570	38% Co, 30% Ni, 20% Cr	114,000	1800	33 R_C @ 1200F	8.6
440-C	17% Cr	——	——	——	——
BOLTS, ETC.					
19-9DL	19% Cr, 9% Ni	52,000	1750	——	9.8
19-9DX	19.2% Cr, 9% Ni,	52,500	1750	89.8 R_B @ 1000F	9.8
A-286	26% Ni, 15% Cr	61,000	1800	95.4 R_B @ 1000F	9.9
S-590	20% Cr, 20% Ni, 20% Co	48,000	1850	88.5 R_B @ 1000F	8.0
422 Mod	12% Cr	——	——	——	6.5
SPRINGS					
A-286	26% Ni, 15% Cr	61,000	1800	95.4 R_B @ 1000F	9.9
S-816	43% Co, 20% Ni, 20% Cr	66,000	1850	97.2 R_B @ 1000F	7.1
Inconel-X	73% Ni, 15% Cr	80,000	1500+	260-300 BHN @ 1200F	9.0

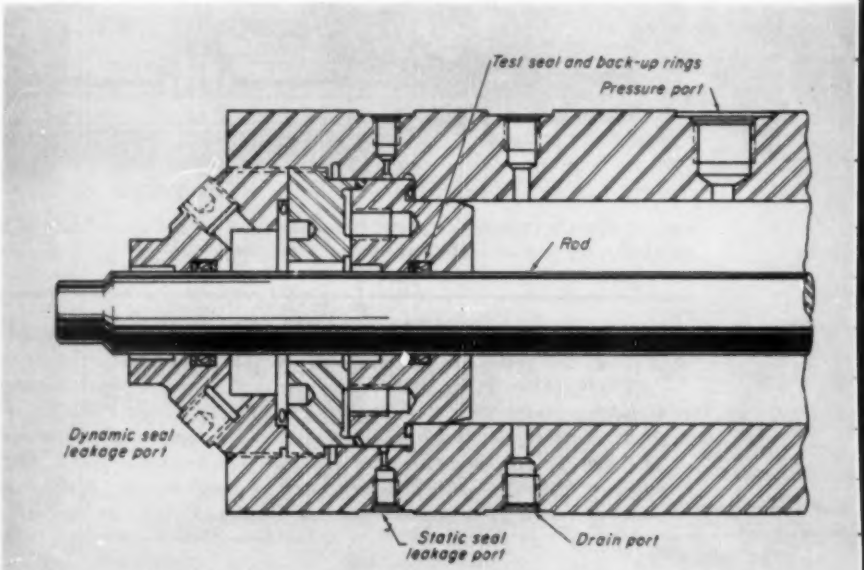

FIG. 1. THE CYLINDER used for testing high-temperature elastomeric seals by Republic Aviation Corp. Continuous measurement of both static and dynamic seal leakage is possible.

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strength than the AISI300 series stainless steels. Also, it can be fabricated by conventional hot and cold-working techniques. Flares show no cracks or tears on the tube ID or OD after working at temperature and pressure. This alloy was designed for use at 1200° F to 1500° F temperatures and has creep resistance above 1200°F that is better than that of other austenitic, heat-resistant alloys.

• **Seals**—Much work has been done by airframe manufacturers, equipment manufacturers, government and private organizations to develop dependable high-temperature seals. Metallic seals of some type may be the answer. North American, Boeing, and Republic Aircraft have concentrated on developing and testing both elastomeric and metallic actuator rod seals. This seal is the most critical in the system because its failure can lead to total system failure and loss of the aircraft and pilot.

Tests at Republic on elastomeric seals have used OS-45 Type IV fluid at temperatures to 550° F and GE's 81406 fluid above 550° F. Test pressures have been from 3000 to 4000 psi and pressure cycling rates from 35 to 300 per minute were used. Viton A O-rings with ceramic and molybdenum disulfide impregnated Teflon backup rings will work at temperatures of 700° F for a reasonable time. Some specific tests results are: 250,000 long and 500,000 short-stroke cycles at zero to 450° F and zero to 3000 psi and 134,000 short-stroke cycles with a high fluid temperature of 680° F (64,500 cycles were at temperatures of 650° F to 680° F) before excessive leakage developed. A hard chrome plated rod with 5 microinch RMS finish was used in these tests, see Figure 1.

Metallic seals such as piston rings, reed seals, labyrinth seals and others of special design, Figure 2, have been under development and test for several years now with encouraging results. North American and Boeing have done much of this. Surface treatments such as flame plating and Electrolyzing are being tried as possible ways to overcome the heating, seizing, and high-friction tendencies of some of the materials.

Sealing is a tough problem, but it looks as though it can be licked. It hasn't been too long since 400° F looked like the end of the line for organic seals. Now, it looks like they can be used at 700° F, and metallic seals will work at even higher temperatures.

• **Other Approaches**—In case no real solution to the fluid problem is found, other ways are going to have to be worked out to make high-temperature hydraulic systems work. For example, if a fluid with all the necessary properties but thermal stability is eventually found, cooling systems may be needed. The added weight and complication of a cooling system are not wanted, of course.

Fluid with a low bulk modulus which evolves gaseous products when exposed to high temperatures will need some way to keep bulk modulus from getting even lower. This would be a deaerating or degassing valve, and again means more weight and something else to go wrong.

Complete flushing of the system after one or two flights may be better than complicating the system. Low temperature limitations may have to be changed to get the needed high-temperature performance. System simplification to eliminate as many places as possible where sealing is necessary should be practised. Packaged assemblies, for example, eliminate many connections and leakage points. ▼▼▼

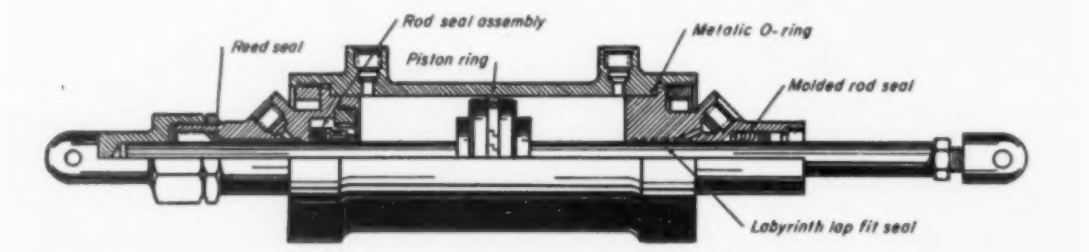

FIG. 2. THIS MYTHICAL CYLINDER shows some of the many kinds of metallic seals being tested to determine their suitability for use in high-temperature hydraulic systems.

"Progress of future fluid power system designs will be governed, to a great extent, by advances achieved in fluids and seals. Any breakthrough on these two basic elements will accelerate system development."

"The problem areas with regard to fluids involve physical properties such as lubricity, bulk modulus, high-temperature stability, viscosity, flammability, and radiation resistance. Certain materials, such as Bis ether, exhibit good, high-temperature stability and excellent resistance to radiation but become solid at 20 F. On the other hand, certain materials are fluid at —100 F, thermally stable at 550 F, but are poor in lubricity. Therefore, it will be necessary to design systems and components around the fluid limitations."—SORRO PRETE, Hydraulic and Pneumatic Section, WADC, at the Fall 1958 Meeting of SAE Committee A-6.

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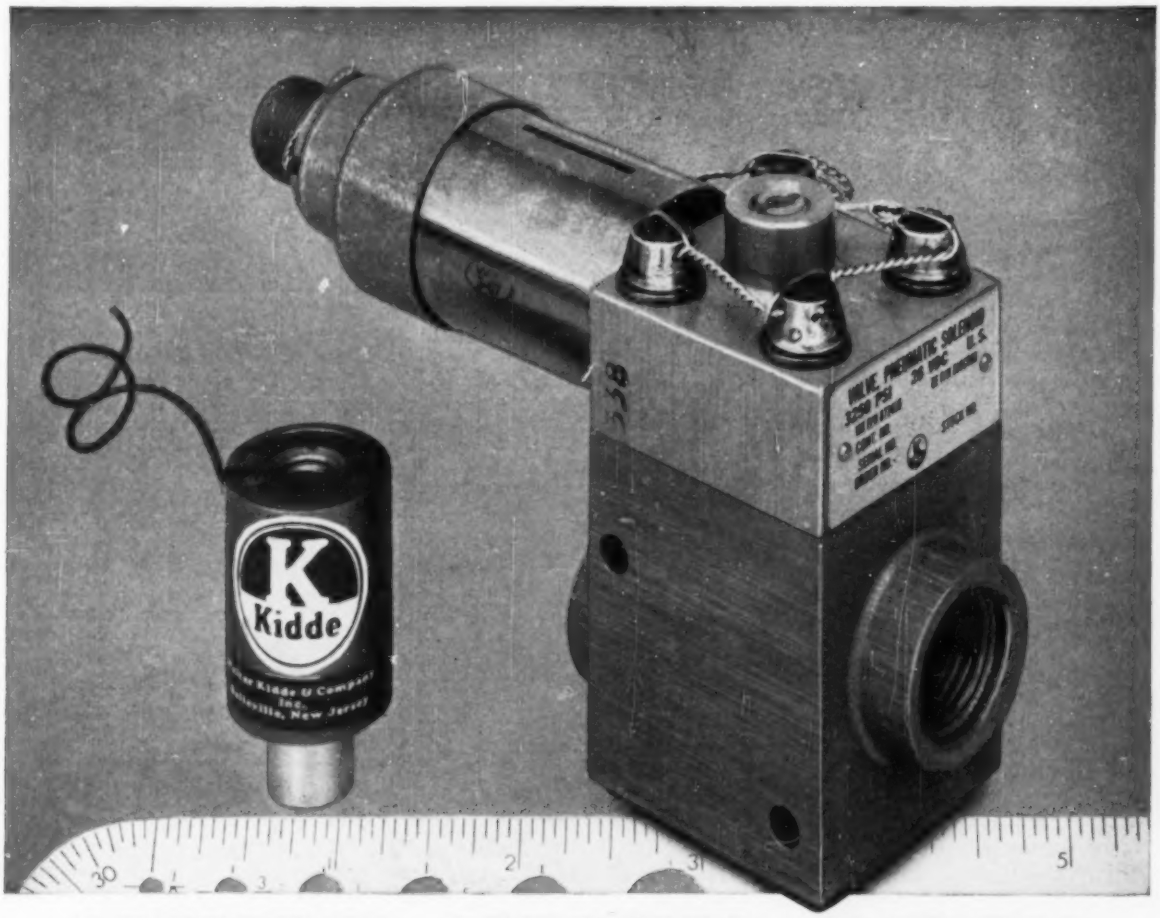

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Flow Factor 1.37
Voltage Range 18 to 30 V.D.C.
Current (28 V. @ 80°F.) 1.2 amps.
Coil Resistance (80°F.) 21.5 to 24 ohms
Weight 1.40 lbs
Response Time 0.018 seconds

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CIRCLE 56 ON TIME-SAVER CARD

Fluid power at Farnborough – 1958

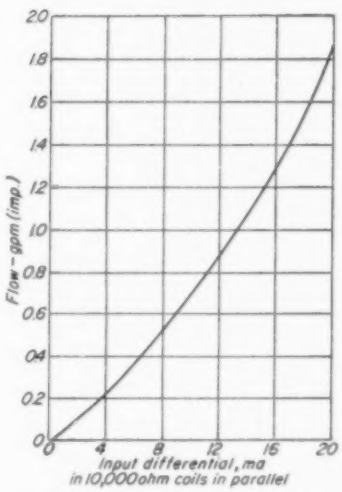
• By John A. Lankester, *A. R. Ae. S., European Editor*

THE Society of British Aircraft Constructors holds their annual Exhibition and Flying Display in Farnborough, England during the first week in September, each year. As a part of this, there are always many new fluid power developments for aircraft use. This year's show was no exception.

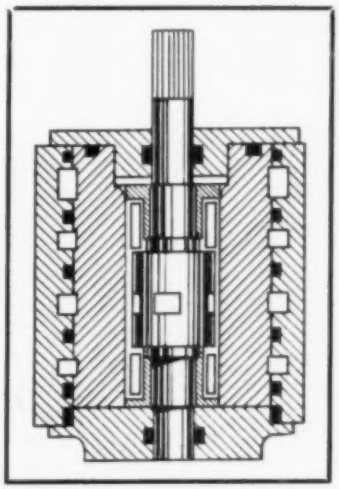
• **Ramjet System**—Hydraulic equipment for a Mach-3 ramjet aircraft was shown by Turner Mfg. Co., Wolverhampton, England. Since the ramjet engine has no rotating parts and cannot drive hydraulic pumps, much of the hydraulic power is provided by ground-charged accumulators. Hydraulic cylinders are used to eject the entire pilot's compartment because the Mach 3 speed makes an ejection seat impractical. Hydraulic cylinders which are a part of the capsule, extend retarding surfaces to slow the capsule before the parachutes to lower it are opened.

Flying controls for this aircraft are the Turner-Le Duc design using coaxial construction to keep size and weight to a minimum.* Another interesting application of hydraulics on this aircraft is in the fuel metering system. A six-stage controller meters fuel to the six stages of the ramjet engine. Each controller stage is a diaphragm-operated valve. The valves are plungers which move up and down in ported sleeves. To keep friction down and increase control sensitivity, a hydraulic motor rotates the sleeves continuously, and virtually eliminates breakaway friction.

• **Pumps**—New York Air Brake Co. Stratopower pumps built in England under license by Integral Ltd. were shown. These pumps are 7, 9, and 11 axial-piston types for pressures to 5000 psi with delivery rates of 1 to 30 gpm at drive speeds of 3000 to 5000 rpm.



PERFORMANCE CHARACTERISTICS of the Fairey servo valve.



SECTION through the Hobson rotary valve.

• **Valves**—Fairey Aviation Co., Ltd. showed a new hydraulic servo valve which consists of a short sleeve with optically flat ends that moves between the optically flat surfaces of two platens. Moving parts are designed for minimum inertia and static and dynamic forces are balanced. Input to the valve is through a torque motor. Input current vs. flow characteristics are shown. Where flow rates higher than 1.8 Imperial gpm (approximately 2.2 U. S. gpm) are needed, the valve may be used as the pilot for a higher capacity valve. Thirty Imperial gpm at 5000 psi can be handled this way. Pressure to 4000 psi can be handled by the first-stage valve.

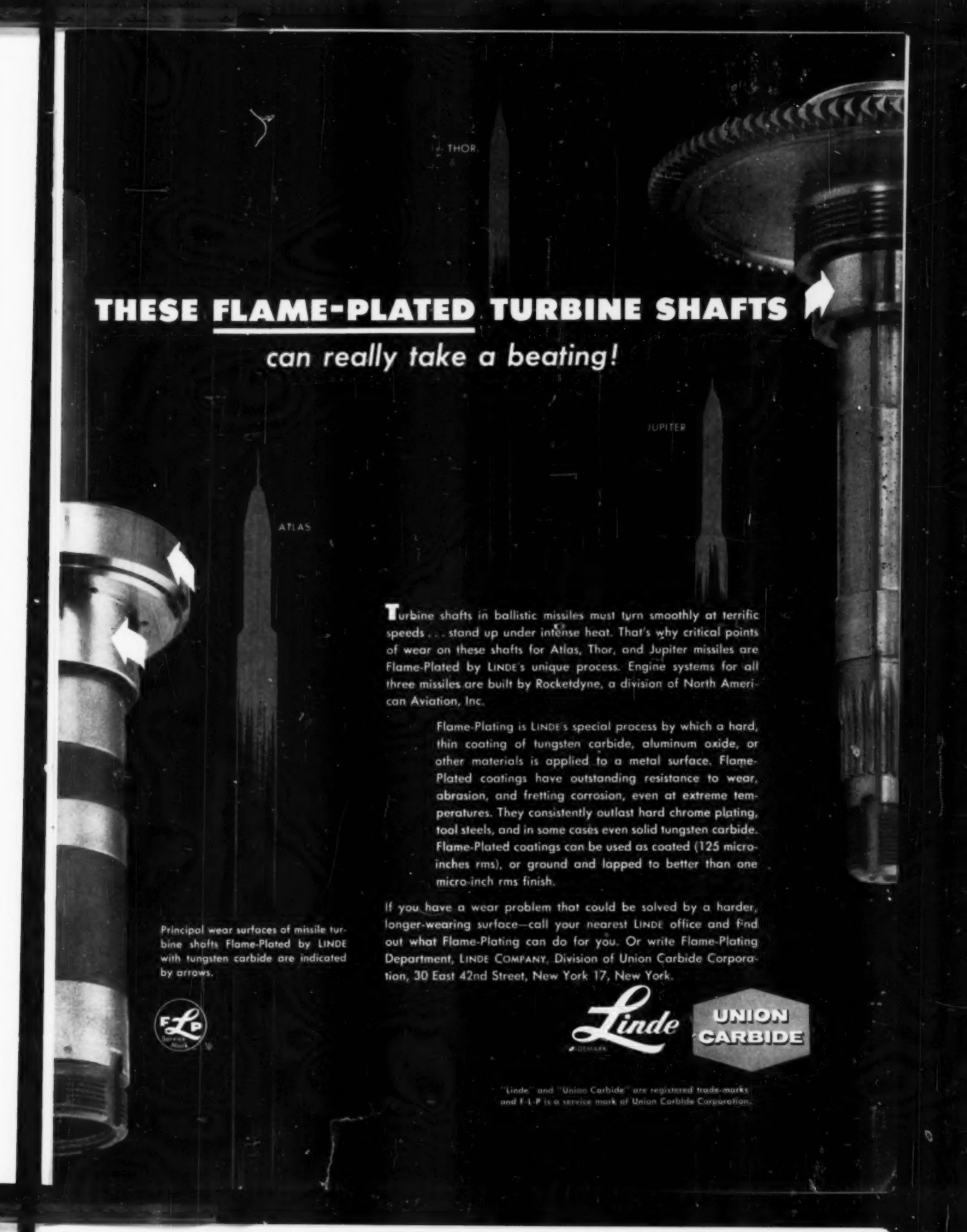
A new rotary valve has been introduced by H. M. Hobson Ltd. The rotor is supported by two roller bearings to eliminate contact with the stationary part of the valve. Clearance between the rotor and sleeve is 0.00025 in. This clearance keeps leakage down, but still prevents silting and keeps breakaway friction low. Port design keeps dynamic forces due to fluid flow down. Both manual input through a differential lever or torque motor input may be used.

Moog servo valves are now being made in England by Dowty Equipment Ltd., Cheltenham, England under a licensing agreement with the Moog Valve Co. of East Aurora, N. Y.

• **Filters**—Filters for 3 gpm at 3000 psi and 14 gpm at 4000 psi were displayed by Fairey Aviation. A range of filters to handle up to 40 gpm at 4000 psi was shown by Palmer Aero Products Ltd. These are made under license from Parmatic Engineering Ltd. of Canada. Sintered bronze elements are used. They remove 100% of 5-micron particles and 98% of 2-micron particles. These filters also have automatic sealing

**A future issue of* APPLIED HYDRAULICS & PNEUMATICS *will have a detailed description of the Turner-LeDuc flying controls.*

CIRCLE 59 ⟶



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Turbine shafts in ballistic missiles must turn smoothly at terrific speeds . . . stand up under intense heat. That's why critical points of wear on these shafts for Atlas, Thor, and Jupiter missiles are Flame-Plated by LINDE's unique process. Engine systems for all three missiles are built by Rocketdyne, a division of North American Aviation, Inc.

Flame-Plating is LINDE's special process by which a hard, thin coating of tungsten carbide, aluminum oxide, or other materials is applied to a metal surface. Flame-Plated coatings have outstanding resistance to wear, abrasion, and fretting corrosion, even at extreme temperatures. They consistently outlast hard chrome plating, tool steels, and in some cases even solid tungsten carbide. Flame-Plated coatings can be used as coated (125 micro-inches rms), or ground and lapped to better than one micro-inch rms finish.

If you have a wear problem that could be solved by a harder, longer-wearing surface—call your nearest LINDE office and find out what Flame-Plating can do for you. Or write Flame-Plating Department, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

Principal wear surfaces of missile turbine shafts Flame-Plated by LINDE with tungsten carbide are indicated by arrows.

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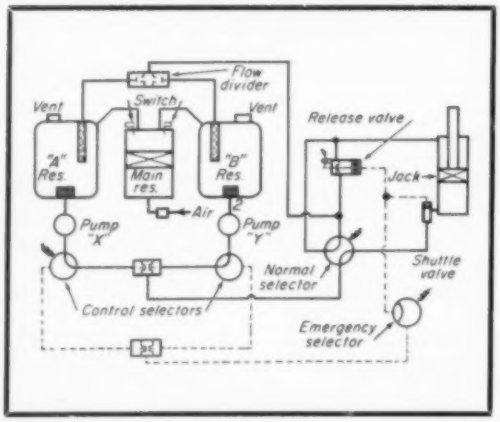
Dept. AH, Bedford, Mass.

CIRCLE 64 ON TIME-SAVER CARD



PRINCIPLE of lightweight fail-safe hydraulic system used on the Blackburn NA 39.

for element changes and automatic bleeding. They have been impulse tested to 100,000 cycles from zero to 6000 psi at a frequency of 6 cps.

• **Lightweight System**—Britain's newest nuclear strike naval aircraft, the Blackburn NA 39, incorporates a hydraulic system specially designed to handle emergency conditions without the weight that goes with system duplication. A pressurized main tank feeds two emergency tanks. Each emergency tank feeds a pump. Oil is not fed from the main tank directly to a pump or pumps. The circuit diagram is simplified and only shows one cylinder. Connections for the other cylinders would be the same.

If one of the pumps should fail, system operation is normal except for the reduced operating speeds. A leak in the tank or between the pump and tank lets the air pressure in the main tank move the divider piston to the end of its travel. This operates the emergency switches in the tank to warn the pilot that he is on emergency. It also switches the control selectors to emergency position. Operating the emergency selector then operates the shuttle valve and release valve to extend the piston. The release valve locks open so the system cannot be operated again until the release valve is reset.

The system operation is the same for leaks upstream or downstream of the normal selector. Of course, if it is downstream of the selector, it won't show up until the selector is operated by the pilot.

• **Ground Handling**—An application of hydraulic power to ground handling seen at the Farnborough Show was a hydraulically-operated mobile passenger stair made by Edghill Ltd. of Hook, England for Pan American Airways. Hydraulics are used to extend and retract the stairs, actuate pawls to lock the stairs so they cannot shift in case of hydraulic failure, and stabilize the truck and stair by extending four cylinders at the corners of the truck. ▼▼▼

MOBILE PASSENGER STAIR uses hydraulics to extend and retract stairs and to stabilize the vehicle while passengers are using the stair.

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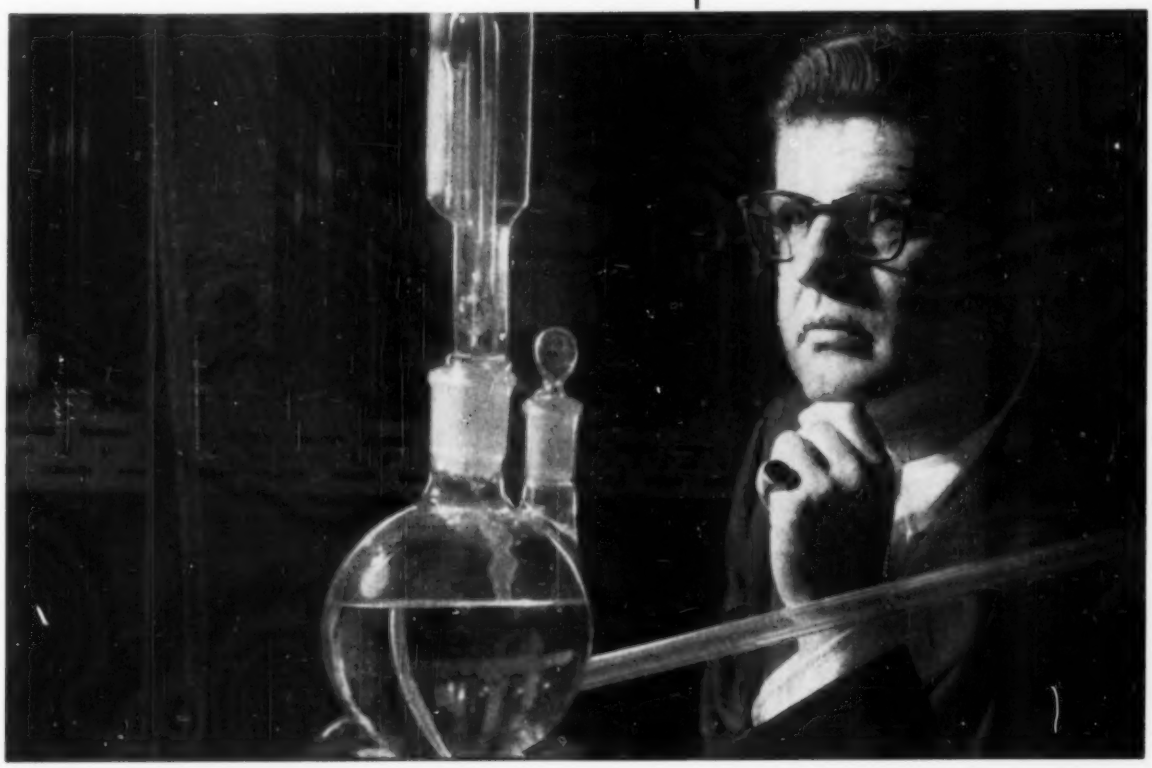

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CIRCLE 1 ON TIME-SAVER CARD

Fall Wiper Ring SPRING LOADED

The Fall "CJ"* Wiper-Scraper Ring is Spring-Loaded causing Squeeze-Grip Action on the O.D. of the piston rod during entire cycle. This patented feature maintains a uniform, continuous pressure on the wiping edge of the ring at all times, stopping any buildup of foreign matter between the ring and the rod.

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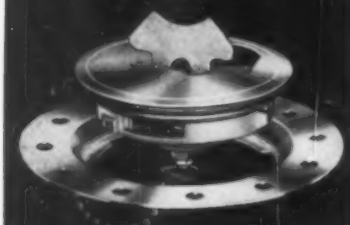

TANK FILLER CAP

The Model FC-3500 is the first tank filler cap to successfully pass all test requirements of MIL-C-7244B (ASG) applicable to fuel, oil, alcohol-water and hydraulic reservoirs.
Lever action design permits cap to be opened safely under pressure and removed completely with only a 35° turn. Now available in 1.5, 2, 3, and 3.82" openings.
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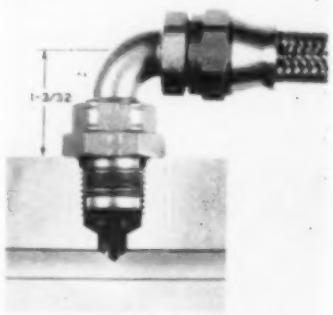
WINDSOR LOCKS, CONN.

CIRCLE 37 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

Universal Fitting
. . . saves weight

In ½-in. size fitting gives a 48% reduction in weight. It is made for use in AND 10050 bosses in accordance with AND 10064. Bosses

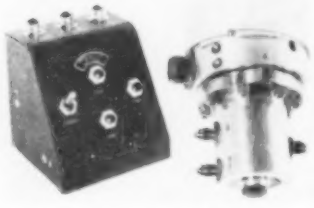


may be closer together since no swing clearance is needed. The fitting is made in both integral hose fitting and bulkhead adapter types, in aluminum and stainless steel.—*Aeroquip Corp., Jackson, Mich.*

CIRCLE 500 ON TIME-SAVER CARD

Air Pressure Regulator
. . . for 6000 psi

Designed for systems that operate at different pre-set pressures, the RV-23E valve gives infinitely

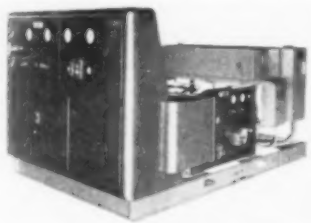


variable pressure settings over a wide range. It is equipped with 3 continuous-duty solenoids wired to a 3-way switch and a 2-position panic switch. The panic switch vents the valve reducing the pressure to any desired level. Inlet pressure range is 50 to 6000 psi with a reduced pressure of 30 to 200 psi below inlet pressure. Conforms to MIL-R-8572A.—*Marotta Valve Corp., Boonton, N. J.*

CIRCLE 501 ON TIME-SAVER CARD

Gas Booster
. . . is hydraulically driven

Built for guided missile ground support equipment the model 9764 boosts gas inlet pressures of 100 to 2200 psi through three stages of compression, and delivers up to 6000 psi. It has a capacity of 80 cfm. The hydraulic drive permits operation with variable inlet pressure without requiring a reducing valve. Unit is air-cooled and requires



no lubrication. The assembly is complete with all valves, pressure gages, and safety devices. Stainless steel tubing and fittings are used throughout.—*Haskel Engineering & Supply Co., Glendale, Calif.*

CIRCLE 502 ON TIME-SAVER CARD

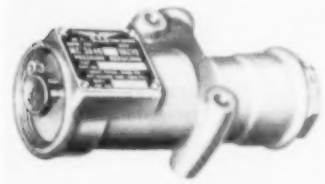
Servo Valves

A new catalog on low-flow servo valves contains curves and schematics which show the design and performance of the valves for military, industrial and research applications. The 3-color, 6-page brochure has a detailed glossary of servo valve terms and a cutaway photograph of a typical valve in the series. *Moog Valve Co. Inc., East Aurora, N. Y.*

CIRCLE 503 ON TIME-SAVER CARD

Reducing Valve
. . . for high pressure air

Designated MC 3640 the valve is compact and lightweight. Made for airborne pneumatic systems it meets MIL-R-8572. With pressure at the inlet port from 1435 to 3000 psi, pressure at the outlet port is



held at 1185 to 1315 psi. Can be made with an integral relief valve. Will operate at temperatures from —65 to 160 F and has port connections for $\frac{1}{4}$-in. tubing. Weight is .55 lbs. Modified springs can be installed to give other outlet pressures.—*The M. C. Mfg. Co., Lake Orion, Mich.*

CIRCLE 504 ON TIME-SAVER CARD

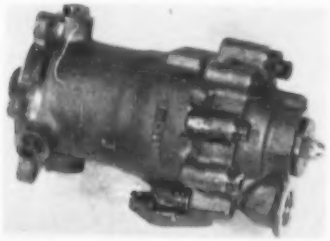
Hoses of Teflon . . .

. . . and related products are the subjects of catalog No. 103 released by *Aeroquip Corp., Jackson, Mich.* The 66 page book gives complete dimensional information, engineering data, assembly instructions and other important facts about medium and high pressure hoses of Teflon and "super gem" fittings for aircraft. A selector chart gives general information on hoses recommended for specific applications.

CIRCLE 505 ON TIME-SAVER CARD

Hydraulic Pumps
. . . for high temperatures

Constant-pressure, variable-volume, piston-type for aircraft and missile hydraulic flight control systems. Made with either single or



dual pumping elements, for speeds up to 7500 rpm. Fluid temperatures to 550 F and ambient temperatures to 600 F. Capacities to 27 gpm with

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CIRCLE 109 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

pressures to 4000 psi. Maintains high volumetric efficiency because of low internal leakage. Metallic seals are used throughout. Shaft seal is metal bellows type.—*Pesco Products Div., Borg-Warner Corp., Bedford, Ohio.*

CIRCLE 506 ON TIME-SAVER CARD

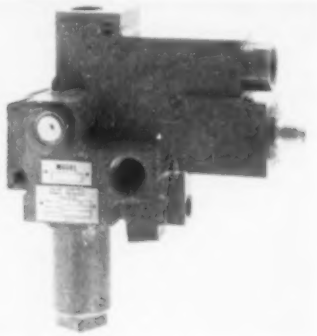
Hydraulic Actuator . . .

. . . for use in in-flight wing flutter test uses electro-hydraulic servo system that controls vanes which oscillate in the airstream regulating force, frequency and amplitude. The device will automatically sweep through a wide band of frequencies. If values of wing flutter velocity, aerodynamic force, or servo error exceed the set limits, a red light flashes and the solenoid bypass valves are de-energized. This causes the vanes to trail, delivering no load to the wings. Designed by *ElectroSystems Inc., Alhambra, Calif.*, the wing unit weighs only 39 lbs and will deliver 200 lbs force to the wings.

CIRCLE 507 ON TIME-SAVER CARD

Selector Valve . . . for 3000 psi

Enclosed in the housing of the HP610100 valve is a solenoid-operated selector valve, a metallic mesh filter with differential indicator, a system relief valve, a gage snubber, and ports for pressure, auxiliary system and return. The



package is designed for 3000 psi and each component has been individually qualified. In addition to its weight and space saving features, reliability is increased by eliminating connections, also assembly time is speeded up.—*Hydra-Power Corp., New Rochelle, N. Y.*

CIRCLE 508 ON TIME-SAVER CARD

Auxiliary Power Pump . . . runs at 24,000 rpm

Has an internal cartridge consisting of hardened steel gears running in a cast iron housing and supported by carbon journal bearings. A pressure-clamping feature gives

fixed end clearance throughout the entire operating range. Rating is 0.3 gpm at input shaft speed of 24,000 rpm, 80 psi inlet pressure, and a pump rise of 725 psi. Designed for using Ethylene oxide as fluid media.—*Lear Inc., Lear-Romec Div., Elyria, Ohio.*

CIRCLE 509 ON TIME-SAVER CARD

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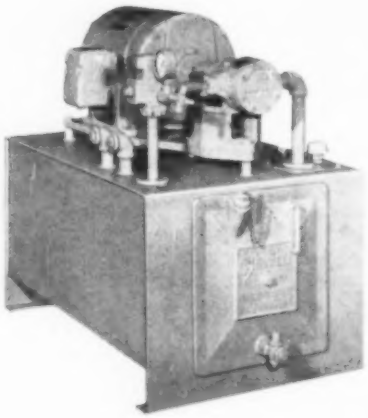

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MARSH

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CIRCLE 60 ON TIME-SAVER CARD

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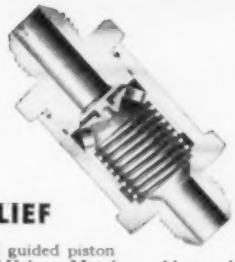
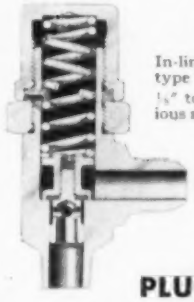
CHECK

Quality Check Valves of several types—ball, poppet, Hy-pressure, Free-flow—all metals, various portings, and pressures up to 5000 psi. Pipe and tube sizes up to 2".



RELIEF



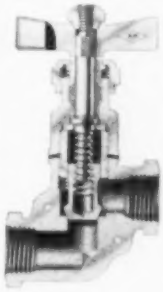
In-line and guided piston type Relief Valves. Metal or rubber seal. ⅛" to ¾" pipe or tube connections. Various metals. Many settings to 2750 psi.

Also Pilot-operated type, with quick unloading and silent operation, ¼" to 2" to 5000 psi. Remote control pilot available.

PLUG

Precision-made Plug Valves for wide general use in brass, aluminum alloy, or stainless steel, ⅛" to 1". +32° to 160°F. With Teflon plug, -65° to 250°F, without lubrication. Aluminum alloy or stainless steel.

GLOBE AND NEEDLE



Super duty shut-off valves, angle and offset, for up to 5000 psi service, ⅛" to 2", with mounting holes, and panel mounting brackets. Also high pressure Needle Valves for 10,000 psi. working pressure—proofed at 25,000 psi. One piece, stainless steel, ⅛" to ½".

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Directional flow control for service up to 6000 psi. Balancing principle uses line pressure to make turning easy with short handle. 2, 3, 4-way, with various drillings. Side, bottom, and sub-plate porting. Panel mounting. ⅛" to 2".

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CIRCLE 80 ON TIME-SAVER CARD

AVIATION NEWS

from the fluid power field

W. H. Seibert was named manager of the support services department at **The Garrett Corp's AiResearch Mfg. Div.**, Los Angeles, Calif. Also **G. E. Irwin** was appointed manager of contract administration and **R. J. Tatge** assistant sales manager.

Dr. Martin Schilling, one of the Army's top missile scientists joined **Raytheon Mfg. Company's Missile Systems Div.**, Waltham, Mass. He will serve as programs manager and director of advanced development. He holds the Army's distinguished service award for accomplishments in technical direction of missile development.

The Navy Department has awarded a $144,000 contract to **The Cornelius Co.,** Minneapolis Minn., for high-pressure compressors to be used on the Martin P5M, Grumman S2F, and Lockheed P2V.

Sundstrand Turbo, Pacoima, Calif., published a 36-page brochure covering its departments of research and development, testing, and production. Titled "Capabilities and Facilities," it gives a complete description of the type and quality of work done by the company.

Robert Lent has been named director of marketing at **Statham Instruments, Inc.,** Los Angeles.

Robert Lent
Statham Instrument Inc.

He had previously been sales manager at Baldwin-Lima-Hamilton Corp.

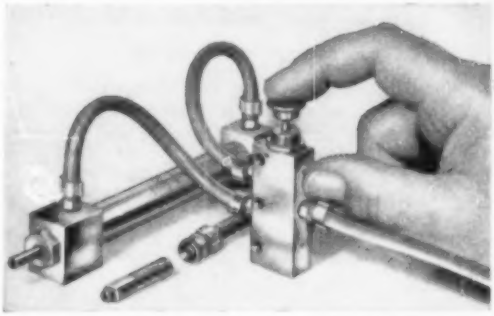
The Weatherhead Co., Fort Wayne Div. (Industrial) and Cleveland Div. (Aircraft) announced the 185 winners in their "Win With Ermeto" contest. First prize of $1,500 was awarded to Lovell O. Hatfield, Jr., of Douglas Aircraft Co., El Segundo, Calif. His manuscript covered the use of fittings for testing prototypes in aircraft hydraulic systems. A second prize of $1,000 was awarded Gerald Coyne of Radiaphone Co., Inc., Monrovia, Calif., for his story on the use of fittings in supplying liquid nitrogen under high pressure in missile count-down just before firing. Eight third prize winners receiving $750 each were: Joseph Naymick, Harris-Intertype, Cleveland; John F. Murphy, Pfaudler Co., Rochester; F. M. Menzel, Rich Mfg. Co., Portland, Ore.; Philip J. Guillot, RCA, Moorestown, N. J.; F. B. Courteney, Carrier Conveyor, Louisville; Charles F. U. Stoner, Fairchild Missile & Aircraft, Hagerstown, Md; Charles A. Davis, Ohio Brass, Mansfield, O.; R. W. Hughes, Joy Mfg. Co., Michigan City, Ind. Balance of the prize money was distributed as follows: 35 awards of $100, 40 awards of $50, and 100 awards of $10.00.

Over 3000 engineers in the United States and foreign countries requested entry blanks and over half of these participated in the competition.

President Albert J. Weatherhead, Jr., congratulates Lovell O. Hatfield, Jr., winner. Holding winning entry is Leo Devlin, Chief engineer of Douglas, and S. C. Howell, General Manager, western division of Weatherhead.

CIRCLE 23 ON TIME-SAVER CARD

NEW! MORE Powerful 9/16" MINIATURE AIR CYLINDERS · 4-WAY AIR VALVES · QUICK CONNECTS



NEW more powerful 9/16" bore spring return and double acting MINIATURE Air Cylinders to complement our widely used 3/8" bore cylinders. NEW 4-way Air Valve, Quick Connects, A.C. and D.C. Solenoids, fittings, mountings and other needed items to improve your automatic tooling and production devices or new end products. Made for MILLIONS of cycles of trouble-free operation! Modestly priced.

Write NOW for NEW Bulletin MA →

Clippard INSTRUMENT LABORATORY, INC.

7368H Colerain Rd., Cincinnati 39, O. • Phone: JA 1-4261

Manufacturers of R. F. Coils, Electronic Equipment, Miniature Pneumatic Devices

CIRCLE 40 ON TIME-SAVER CARD

NEW

SINGLE OR 2-SPOOL VALVE

MODEL WP

PARALLEL VALVE

for heavy duty industrial mobile hydraulic applications

GRESEN HYDRAULICS

Capacity: **40 GPM** at 20 ft./sec.

MAX. PRESSURE: 1500 PSI

Features: **SPOOLS** – fully balanced, self centering, accurately feathered for fine metering action – separate ball checks for each spool.

CARTRIDGE type relief valve has hardened seat.

TRIPOD mounting feet for easy installation.

CHOICE of many modifications.

WRITE FOR LITERATURE

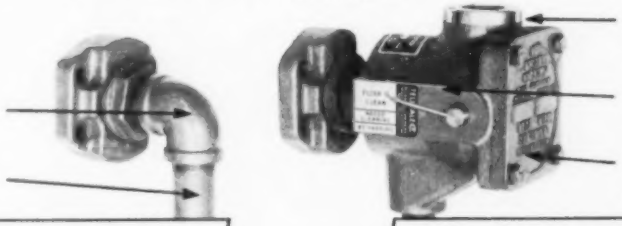
GRESEN *Mfg. Co.*

405 35th Ave. N.E., Minneapolis 8, Minn.

Compare—See Why Tell-Tale® Filters Are Best

PATENTS APPLIED FOR

Note the built-in dangers in the old system below



Piping removal necessary to clean filter boosts maintenance cost.

Wrong sized pipe often used, due to size of inlet-port on pump.

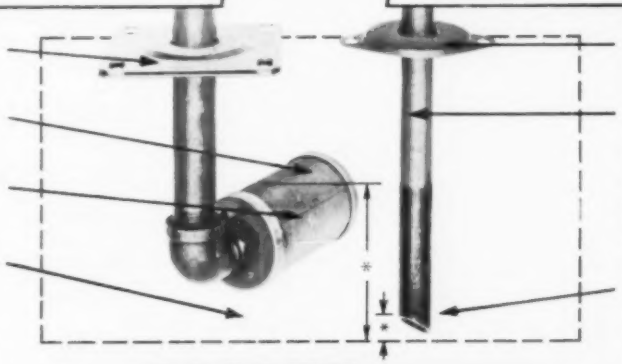
See oil through glass port, prevent dry starts or air entrainment going unnoticed.

Indicator tells when to clean the filter.

Filter reached for cleaning through end-plate. Normal cleaning time: only 5 minutes.

Ordinary Suction Filter Assembly

Tell-Tale® Suction Filter Assembly



In-tank filters require more costly openings and pipe retainers.

Impossible to determine when to clean with filter submerged in tank.

Clogged filters cause 90% of pump failures (by cavitation).

Tank must be cleaned often to remove settled dirt. Dirt breaks down oil and additives.

*Depth of oil that cannot be utilized. Low intake-pipe opening with Tell-Tale permits more oil to be used.

Only small round hole needed, for minimum installation cost.

Proper pipe size assured by following Tell-Tale inlet-port size.

Tell-Tale pressure-drop controls prevent pump cavitation. Proper control is selected to suit make and type of pump.

Low intake-pipe opening keeps tank clean, promotes longer oil life.

Tell-Tale filter assembly replaces ordinary assemblies without rearranging other components.

The ROSAEN COMPANY

1776 EAST NINE MILE ROAD • HAZEL PARK, MICHIGAN

CIRCLE 84 ON TIME-SAVER CARD

NEW PRODUCTS

FLOW CONTROL VALVE
. . . is temperature compensated

Features: Reduces flow variations from temperature changes by 75%. Sensing mechanism automatically

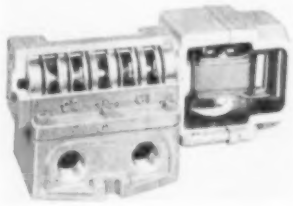
varies orifice size to compensate for changes in fluid viscosity. Requires no external drain. Built-in check valve for reverse flow. Replaces 12 models in the 5 to 1000 cipm range and is interchangeable with any of them. Maximum reverse flow 1400 cipm. Adjustment is tamper-proof. An optional anti-jump feature reduces the inlet opening with sudden pressure surges.

Vickers Inc.
Marine & Ordnance Dept.
Waterbury, Conn.

CIRCLE 309 ON TIME-SAVER CARD

FOUR-WAY AIR VALVES
. . . have controlled expansion seals

Features: Leakproof sealing from 28 in. vacuum to 150 psi. Low breakout friction. Have balanced direct-operated spools which, with the controlled expansion seals, allow the use of small, low-amperage solenoids. Short stroke and direct operation allow complete valve re-



versal in less than one electrical cycle. Valve passages exceed area of standard pipe.

Specifications: Single or double solenoid types and air pilot operated in ¼, ⅜, ½, and ¾ in. NPT. Seats are replaceable.

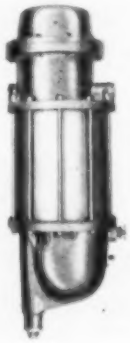
Air Valves Co.
Warren, Mich.

CIRCLE 310 ON TIME-SAVER CARD

AIR LINE FILTER
. . . with automatic ejector

Designation: Arid-Air

Operation: The first stage separates moisture and heavy contaminates and discharges them. The sec-



ond stage filters out oil and microscopic particles. Moisture ejector is float operated and may be used with continuous or intermittent air flows.

24-HOUR DELIVERY!

and one low price for any of 4 mountings!

C20 SERIES HEAVY-DUTY Non-Cushioned

AIR or HYDRAULIC CYLINDERS . . .

- 150 psi air—500 psi hydraulic, all bore sizes
- HEADS—sturdy cast semi-steel
- RODS—hard chrome plated, all supplied with wrench flats and wipers
- BORE sizes 1½" to 6" with strokes up to 24" stocked for 24-hour delivery
- QUICK delivery on other strokes

Write, NOW, for Bulletin #358

SHEFFER PNEUMATICS HYDRAULICS

THE SHEFFER CORPORATION

Cincinnati 15, Ohio • Phone: VAlley 1-0320

Manufacturers of the industry's most complete line of air and hydraulic cylinders

SOLD BY LEADING DISTRIBUTORS NATIONWIDE

CIRCLE 87 ON TIME-SAVER CARD

TRU-SEAL

TEFLON SEAL

PAT. PENDING

Saves hours in piping installations

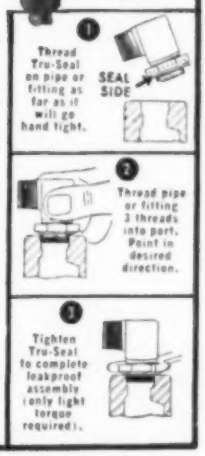
Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write.

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
2008 N. Hawthorne, Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

CIRCLE 96 ON TIME-SAVER CARD

Will handle up to 1300 cfm and discharge up to 500 gal of moisture per hour with no loss of air. A textile cartridge removes particles down to 5 microns and can be replaced without removing the unit from the line.

Specifications: Made in ½ to 3-in. NPT for pressures to 250 psi.

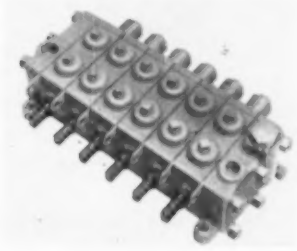
Wilkerson Corp.
Englewood, Colo.

CIRCLE 311 ON TIME-SAVER CARD

SECTIONAL CONTROL VALVES
. . . for mobile equipment

Designation: S4 & S6 Series

Features: Rigid body permits higher pressures without spool bind. Spools are hydraulically balanced and not affected by back pressure. Shifting force is the same in either direction. Sections may be assembled in any sequence. Neoprene ring and wiper seal on stem keep out dirt. Inlet section can be provided with or without a relief valve.



Specifications: Series flow pattern lets more than one cylinder or motor operate at the same time regardless of load. In neutral, cylinder ports are blocked and oil flows directly through the valve sections to the reservoir. Rated for flows to 35 gpm. Can have up to 10 sections. Pressure drop at rated flow, 5 psi for the S4 and 10 psi for the S6.

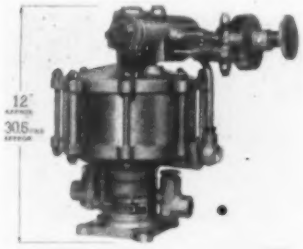
Sundstrand Hydraulic Div.
Sundstrand Machine Tool Co.
Rockford, Ill.

CIRCLE 312 ON TIME-SAVER CARD

AIR-OIL BOOSTER
. . . develops 22,500 psi

Designation: Airhydro

Features: Operates on air supply of 100 psi. Air reducing and control valves give intermediate pressures within the range of each model. Pump maintains static pressure indefinitely without consuming air. Stainless steel internal parts. Packings are rubber reinforced with fabric. For use with all hydraulic fluids and water. Inlet & outlet valves are spring-loaded ball type with cast stainless steel bodies.



Specifications: Made in 9 models with hydraulic pressures from 62 to 25,000 psi. Weighs 52 to 78 lbs. All models are 12 in. high and have diameters from 7½ to 12 in.

Davies Bros.
Gladstone, N. J.

CIRCLE 313 ON TIME-SAVER CARD

Continued on next page

Capital

HYDRAULIC FILTERS

for Hydraulic and Oil Re-circulating Machinery

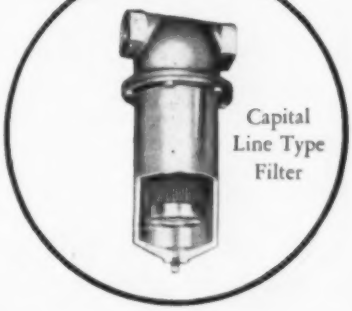
Capital Hydraulic Filter Units are smaller than ordinary filters but with filtering capacity equal or superior to many larger filters. Small size permits greater latitude in design, particularly where space is restricted.

Capital Filter Units are designed with one-piece construction — no screws or nuts to work loose and be lost or mislaid. Simple and easy to clean by any method.

Made from specially designed woven Monel wire, with narrow corrugations presenting the greatest filtering area. Monel support supplies extra sturdiness.

Capital Filter Units are made in 4 Types:

- **MONO-BILT 60 Mesh All Stainless Steel (Sump type).**
- **MONO-BILT Standard All Stainless Steel**
- **MONO-ECONO Mono-Bilt with Monel Metal Insert and Cadmium Plated Top and Bottom.**
- **LINE TYPE with Aluminum Housing and Mono-Bilt, one Piece Filter Unit.**



Capital Line Type Filter

Built from Monel Metal they are impervious to rust and corrosion.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

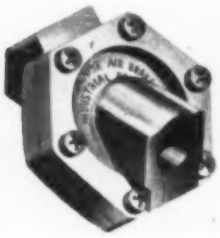
CIRCLE 19 ON TIME-SAVER CARD

NEW PRODUCTS

QUICK RELEASE VALVE
. . . for exhausting air cylinders

Designation: P52935

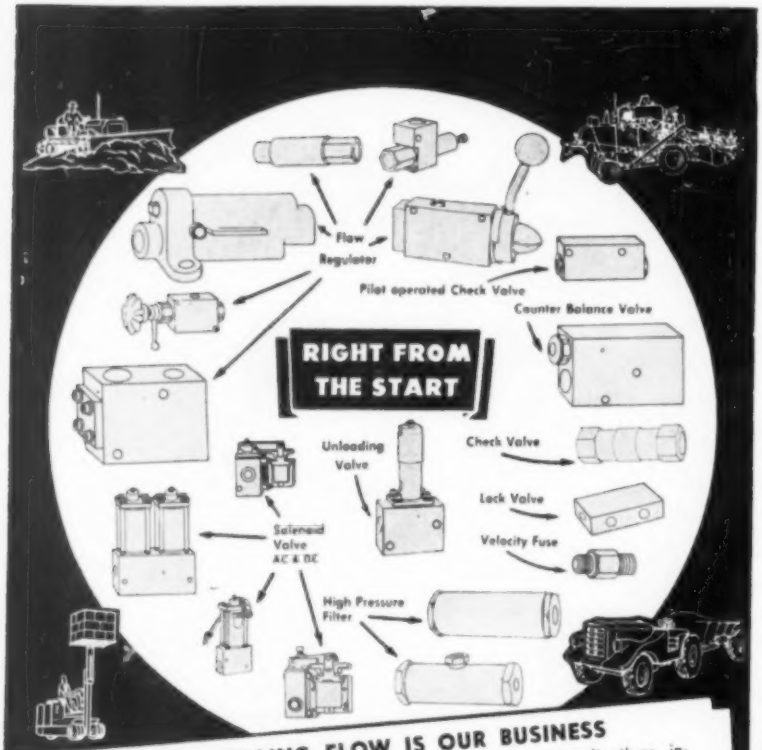
Features: Large internal air passages for quick exhaust. Pressure can be vented in small increments. Ports in-line or at right angles. Aluminum body and oil-resistant diaphragm.



Operation: Air pressure entering the supply port forces the diaphragm against the exhaust port, closing it. Pressure also deflects the rim of the diaphragm opening a passage to the delivery port. When pressure at the supply port is reduced 5 psi it lifts the diaphragm from the exhaust port and seats it on the supply port, allowing air to exhaust to atmosphere.

Westinghouse Air Brake Co.
Industrial Products Div.
Wilmerding, Pa.

CIRCLE 314 ON TIME-SAVER CARD



CONTROLLING FLOW IS OUR BUSINESS

All of the above valves have been used in various types of applications, including Material Handling, Road Building, Machine Tools, Farm Equipment and Earthmoving.
Waterman Engineering Company has also supplied valves to the Military for Ground Support Equipment and Missile Launchers.
We invite you to send us your applications and take advantage of our experience to help analyze your problems.
Bulletins of any of these products sent on request.

Also suppliers of AN and MS qualified Flow Rate and Volume Controls to the Aircraft Industry.

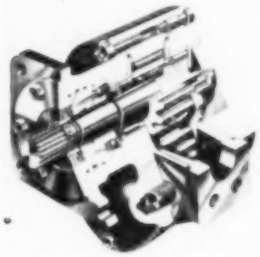
WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE • EVANSTON, ILLINOIS

CIRCLE 106 ON TIME-SAVER CARD

HYDRAULIC GEAR PUMPS
. . . have two-stage shaft seals

Designation: 3000 K Series

Features: Heavy duty roller bearings for tough applications on mobile and earth moving equipment. Spur gear design. Two-stage shaft seal prevents external leakage.



Specifications: Capacity 24 to 65 gpm at 1200 rpm and 1500 psi. Made with standard SAE flange and shaft, or industrial foot mounting. Ports for SAE split flange connections.

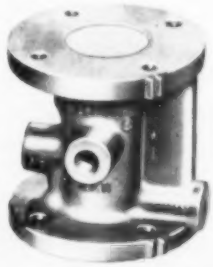
Hydreco Div.
The New York Air Brake Co.
Kalamazoo, Mich.

CIRCLE 315 ON TIME-SAVER CARD

AIR VALVE ADAPTER
. . . extends time delay

Designation: P Adapter

Features: Used as a pilot section it will give delays up to one minute. Designed to work in combination



with the company's TD head and any body in the Skyline series. Can have internal or external pilot supply. Pressure can go directly to each of three working components. A

modification makes it possible to supply pilot air from the valve body, through the body to the head.

Ross Operating Valve Co.
Detroit, Mich.

CIRCLE 316 ON TIME-SAVER CARD

AIR LINE LUBRICATOR
. . . fills automatically

Features: Oil is supplied by pipe line from 55 gal drums at a central pumping station. A float in the

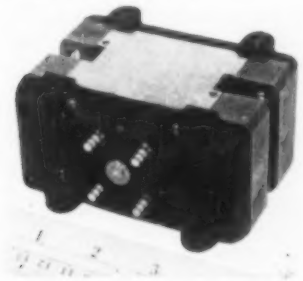
lubricator bowl operates a valve that lets oil in. Hand fill units can be converted to automatic by using the new bowl filling valve. Automatic lubricators eliminate down time for filling and assure lubrication to air operated equipment.

Arrow Tools Inc.
Chicago, Ill.

CIRCLE 317 ON TIME-SAVER CARD

TORQUE MOTOR
. . . to actuate servovalves

Designation: Model 106

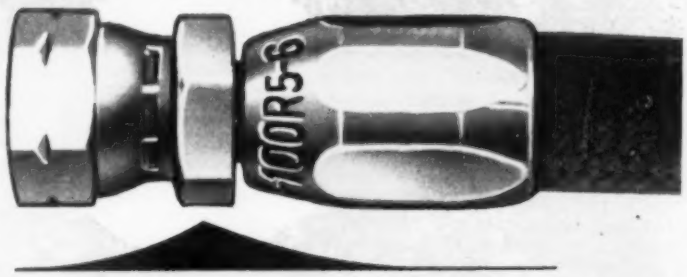


Specifications: Size 4 x 3¼ x 2¼-in. Weight 3.4 lbs. Delivers a 15-lb output force at midposition, and can be driven from vacuum tubes, transistors, or magnetic amplifiers. Input power, 4 watts. Stroke, 0.02 in. Less than 2% hysteresis. Designed for process-control and machine tool manufacturers.

American Measurement and Control Inc.
Waltham, Mass.

CIRCLE 318 ON TIME-SAVER CARD

Save Time and Money
with Flexon Reusable Hose Fittings



ALL FLEXON REUSABLE FITTINGS now equipped with Easy Grip Hex for simple, speedy attachment

There's no longer any need to struggle with special tools when you attach reusable hose fittings. Now you can attach reusable fittings the easy way . . . if the fittings are FLEXON.

Every FLEXON reattachable fitting—male or female—has a hex on the stem. You can get a good grip on the fitting with an ordinary wrench for faster, easier insertion into the hose. And there's no danger of damaging the threads or of damaging the seat of female couplings.

For your hose connector requirements where the serviceability of reusable fittings is desired, improve that serviceability by specifying FLEXON Reusable Fittings with the Easy Grip Hex. Sizes start at $^{3}/_{16}$" hose I.D.

For all your hose assembly requirements take advantage of Flexon know-how. It may be the first step towards reducing your over-all fluid power costs.

Flexon offers the Complete Line

- Bulk hose in a wide range of types and sizes.
- Hose assemblies with standard or special fittings for all pressures.
- A full line of crimped, reusable, swaged, push-on and special fittings, for all services.

On-The-Spot Service for all Your Hose Needs

Your nearby Flexonics field man is as near as your telephone to give you prompt, competent service on all your flexible hose needs. For your further convenience, his service is backed by strategically located warehouse stocks. In addition, the assistance of the Flexonics Hose Application Engineering Department is available to help you with "special" problems. Get all your hose needs from this single, dependable source.

Flexonics Corporation RH-10

Mr. Flexon identifies products of Flexonics Corporation that have served industry for over 56 years.

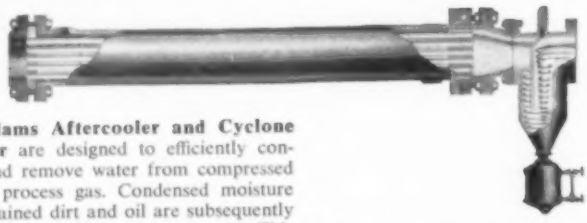
1385 S. Third Avenue • Maywood, Illinois
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario
Manufacturers of metal and rubber hose, expansion joints, metallic bellows and aircraft components.

CIRCLE 33 ON TIME-SAVER CARD

CIRCLE 2 ON TIME-SAVER CARD

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
249East Park Drive, Buffalo 17, New York

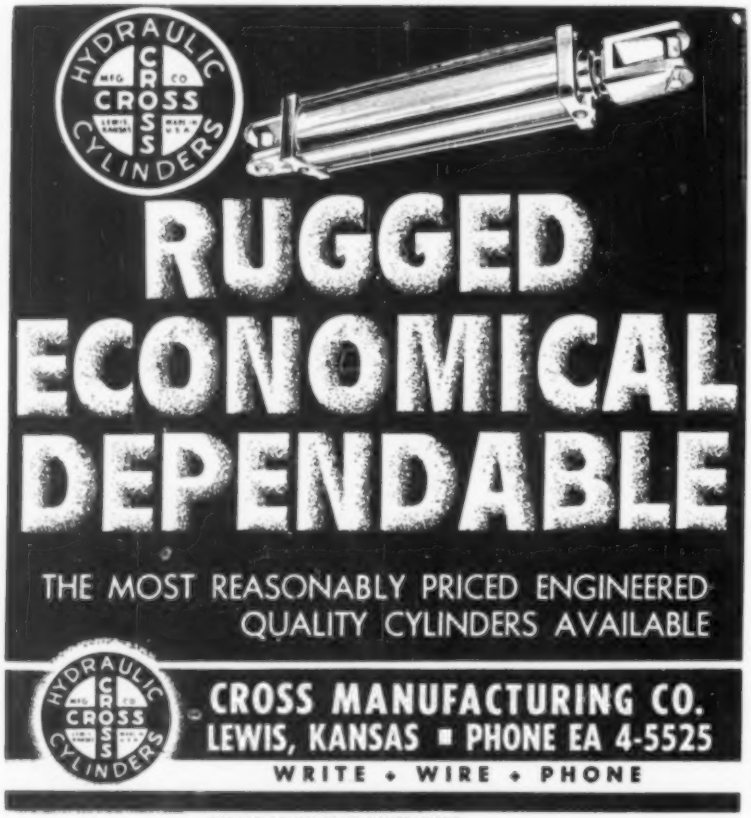


The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.



CIRCLE 25 ON TIME-SAVER CARD

USEFUL LITERATURE

PRESSURE GAGE SNUBBERS . . . and mercury receivers are included in a booklet prepared by *Chemiquip Co., New York, N. Y.* The snubbers are made of corrosion resistant materials in ¼ and ½ in. pipe sizes and are used for pulsation surge dampening on gage lines. The mercury receivers have a capacity of 125 cc and a pressure rating of 3000 psi.

CIRCLE 411 ON TIME-SAVER CARD

CONTROL VALVES . . . featuring a fully guided plug and lift-out seat design are shown in bulletin LB-3 from *Conoflow Corp., Philadelphia, Pa.* It shows how the combination of single-seated valve body and rugged cylinder actuator give rapid response. The bulletin describes design features such as the extra thick body wall which meets 600 psi ASA rating.

CIRCLE 412 ON TIME-SAVER CARD

BRAZED TUBE FITTINGS . . . for close quarters where there isn't room for threaded fittings are illustrated in bulletin 4375 released by *Parker Fittings and Hose Div., Parker-Hannifin Corp., Cleveland, Ohio.* Fittings have a pre-positioned silver alloy ring that requires only insertion of the tube and applying heat. Joint strengths are 130,000 psi in tension and 48,000 psi in shear.

CIRCLE 413 ON TIME-SAVER CARD

HYDRAULIC CUTTING TOOLS . . . with high thrust for shearing wire, rod, steel billets, strip, and tubing are presented in a catalog issued by *Manco Mfg. Co., Bradley, Ill.* The rugged tools, trademarked Gillotine, are all hydraulically operated. Included in the 70-page catalog are power packs, valves, control switches, and handpumps for use with the tools.

CIRCLE 414 ON TIME-SAVER CARD

POWER PACKS . . . for pressures to 6000 psi made with gear, vane or piston pumps are featured in a brochure issued by *Lincoln Supply Co., Pawtucket, R. I.* It gives a

complete description of the units which include suction filters, adjustable relief valves, oil level gages, and air breather and filler caps. Standard units have capacities to 50 gpm and specials can be built to any size.

CIRCLE 415 ON TIME-SAVER CARD

LOW PRESSURE COMPRESSORS . . . for heavy-duty industrial use with capacities to 7392 cfm are covered in a leaflet available from *Joy Mfg. Co., Pittsburgh, Pa.* Included are 2- and 4-cylinder units for developing pressures to 75 psi with power requirements to 1000 hp. Compressors are single-stage, double-acting, and water-cooled.

CIRCLE 416 ON TIME-SAVER CARD

CONTROLLED SPEED SYSTEMS . . . using pneumatic actuator assemblies, torque motors, and tension controllers are illustrated in

a bulletin released by *U. S. Electrical Motors Inc., Los Angeles, Calif.* Typical applications are detailed, including those for pressure, rewind tension, and load synchronization. Systems are applicable to basic handling processes.

CIRCLE 417 ON TIME-SAVER CARD

COMPRESSION PACKINGS . . . in both sheet and rod seal types are described in a pamphlet prepared by *E. F. Houghton & Co., Philadelphia, Pa.* Tradenamed Val-Pac the line has been reduced to only those packings which cover the bulk of industrial uses. Included are roll packings in all types of rubber and asbestos, and sheet packings in cotton, flax, jute, metal and asbestos.

CIRCLE 418 ON TIME-SAVER CARD

RELIEF VALVES . . . pilot-operated cartridge type which can be built into pumps or other hydraulic components are shown in a catalog sheet from *Fluid Controls, Inc., Mentor, Ohio.* Valves are made in four pressure ranges: 50 to 500 psi; 500 to 3000 psi; 50 to 1000 psi, and 500 to 4000 psi. The sheet gives a complete description of the valves featuring standard adjusting screw or hand knob pressure adjustment with leakproof stem.

CIRCLE 419 ON TIME-SAVER CARD

MAGNETIC FILTERS . . . having a cartridge for removing micronic non-magnetic particles are included in a brochure announced by *Wilkinson Mfg. Co., Omaha, Neb.* Filters have an operating efficiency of 99.9% on particles to 5 microns. Included is a graph showing efficiency and pressure drop plotted against contamination.

CIRCLE 420 ON TIME-SAVER CARD

TUBING . . . for aircraft and industrial hydraulic systems is described in bulletin No. 41 produced by *Superior Tube Co., Norristown, Pa.* Tubing materials are grouped as carbon, alloy, and stainless steels; nickel and nickel alloys; copper-base alloys, and reactive metals. Sizes range from .010 to ⅜ in. OD and .125 in. wall thickness.

CIRCLE 421 ON TIME-SAVER CARD

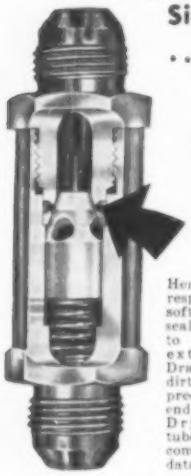
The ARROW AUTOPNEUMATIC CONTROL is the answer to your compressed air problems

Write for Free Catalog

ARROW TOOLS, INC.
1934 S. Kostner Ave.
Chicago 23, Illinois

CIRCLE 10 ON TIME-SAVER CARD

CIRCLE 55 ON TIME-SAVER CARD



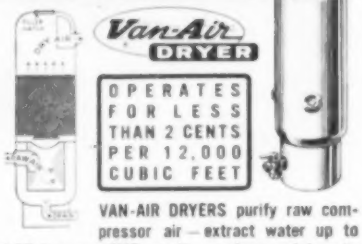
Simple, Secure . . . Leak-Tight! this FLEXIBLE SEAL SEAT*

Here's the secret . . . responsive action of the soft, long-lasting O-ring seal! Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts or extra end seals. Six standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Send for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

HYDRAULIC & PNEUMATIC
CHECK VALVES
* PATENT APPLIED FOR

COMPRESSED AIR DRYERS AND CLEANERS



VAN-AIR DRYERS purify raw compressor air—extract water up to 1.07 lbs. per 1000 cu. ft.—reduce moisture to ZERO-dewpoint—remove contaminating bacteria, scale, etc.—deliver air uniformly clean and dry.

VAN-AIR DRYERS have no elements to heat, regenerate or regulate—average ten minutes care per month—process air automatically with a non-corrosive desiccant (see diagram)—operate with less than 1% pressure drop.

Many plants, shops and labs use the VAN-AIR to protect instruments, testers, circuits, etc. Others use it to prevent fouling of chemicals, compounds, plastics, foods, drugs, etc. Some need it to reduce spoilage in product finishing, spraying, blasting, packaging, assembling, etc. VAN-AIR DRYERS are built in various sizes.

Capacities range from small 10 scfm units to large vessels for entire plant output—up to 8000 scfm and 6000 psig. Write for brochure.

VAN PRODUCTS CO. • MFRS.
5713 SWANVILLE ROAD, ERIE, PA.

CIRCLE 101 ON TIME-SAVER CARD

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Thomas H. Thorensen has been appointed field sales manager for **Hannifin Company,** Des Plaines, Illinois, a division of **Parker-Hannifin Corp.** Thorensen, who joined Hannifin in 1945 as production engineer, will direct all outside sales activities.

T. H. Thorensen
Hannifin Co.

C. A. Thomas
Stratoflex, Inc.

Formerly vice president of sales, **C. A. Thomas** has been named president of **Stratoflex, Inc.,** Fort Worth, Texas. **John Tullis** has become vice president and general manager. **Ben Matheson,** New York representative is sales manager. **Warren Harry** is the new Division manager of the Fort Wayne, Indiana plant, and **W. D. Rothell** is Division manager at Los Angeles.

A. Napier of Logan, W. Va., was named sales representative for **Schroeder Brothers Corp.** He will cover eastern Kentucky, south western West Virginia and western Virginia.

E. L. Spencer was named general sales manager of **Houdaille's Buffalo Hydraulics Division.** He was previously chief executive of the Fairmount Tool & Forging Division.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has completed construction of new engineering, development and research facilities in Greendale, Wis.

Walter A. Penner has been appointed district office manager of the **Worthington Corporation's** Denver district office. Penner joined the company in 1938 and served in various engineering and engineering sales capacities.

Telco Inc., Cleveland, Ohio representatives and stocking distributors of fluid power components, have been appointed exclusive representatives in Northern Ohio for **Bendix-Westinghouse** air and hydraulic cylinders.

Jay Instrument and Specialty Company, representatives for Hanna Engineering Works, has opened a new office at 4918 West 16th Street, Indianapolis, Indiana. **Ray Ruff** is in charge of this office.

Purolator Products, Inc., Rahway, N. J. has named **Jules Kovacs,** vice president in charge of technical sales and **H. C. Mouwen** manager of the Research and

Jules Kovacs
Purolator Prods.

H. C. Mouwen
Purolator Prods.

Development Department. A company vice president in charge of research and development since 1950, Kovac now has expanded responsibilities for new product marketing and special engineering services. Mouwen will be responsible for new product development in filtration and separation.

Continental-Emsco Co. has established an industrial sales department, headed by **R. E. Scheibel.** The new department will have the responsibility for direct and dealer sales of swivel joints and other industrial products.

R. E. Scheibel
Continental-Emsco

V. G. Converse III
Scans Associates

Scans Associates, Inc., a recently organized Michigan corporation, has opened its new offices and plant at 12940 Farmington Road, Livonia, Mich. **Vernon G. Converse III,** president, stated the company will engineer and manufacture hydraulic, mechanical and electrical equipment for the automotive, aircraft and missile industries. Officer Directors are **Stanley R. Andersen, Robert A. Newhouse, Lee J. Seymour** and **Samuel F. Sgriccia.**

I. D. Orvis, formerly assistant general manager and comptroller, has been promoted to the newly created position of general manager of **Dynex, Inc.,** a division of the **Blackhawk Mfg. Co.**

A Boston, Mass., branch office has been opened by the industrial division of **Joy Manufacturing Co.,** at Second Ave., Burlington, Mass. **D. L. Archibald** is the district manager.

The Sheffer Corp., Cincinnati, Ohio appointed three new distributors: **Kober Sales Engineering Co.,** Bay City, Mich., headed by **Fred Kober,** will cover northeastern Michigan. The company also maintains offices in Flint. Southeastern Texas will be covered by **Active Engineering Sales Co.,** Houston, Texas, headed by **Robert A. Monogue.** Washington, D. C., Maryland and Northern Virginia will be served by **N. B. Cochrane Company,** Baltimore, Maryland.

Parker-Hannifin Corporation named two distributors for their line of piston-type accumulators. **The Louis H. Hein Company** with locations in Ardmore, Pa., Jersey City, N. J., and Baltimore, Md.; **Upton Bradeen & James Ltd.,** Toronto, Ontario, Canada.

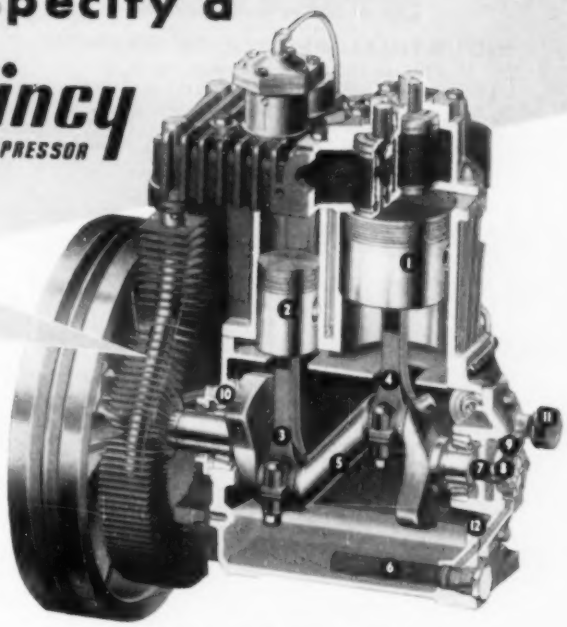
The Flodar Corp., Cleveland, Ohio, appointed **Air Products Company,** Savannah, Georgia, as exclusive distributor. **E. V. Estill** and **R. H. Estill** will handle sales in the states of North and South Carolina, Georgia and Florida. Air Products Company's new expanded quarters will be located at 815 East 66th Street.

B. J. McColl was named assistant vice-president, Industrial Products of **Dowty Equipment of Canada, Ltd.,** Ajax, Ontario. He is responsible for new product developments in the industrial field.

Continued on next page

INCLUDE THESE ENGINEERING ADVANTAGES IN YOUR DESIGN

. . . specify a Quincy COMPRESSOR



1 - 2. Four-ring, light weight automotive-type low and high pressure pistons.

3 - 4. Strong, light weight Lynite connecting rods.

5. Balanced crankshaft with integral counterweights.

6. Oil inlet screen.

7. Drive shaft for new rotary vane-type oil pump.

8. Four-vane oil pump.

9. Self-reversing pump valve.

10. Oversize Timken roller bearings.

11. Easy-reading oil gauge.

12. Intake oil passage in bearing carrier and crankcase.

Here are just some of the design features of Quincy's new Model 325 — one of a complete selection of industrial air compressors to 90 C.F.M. capacity.

SEND FOR CATALOG TODAY

Quincy COMPRESSORS

COMPRESSOR COMPANY
Dept. AH-1258
Quincy, Illinois

Gentlemen: Please send free catalog of industrial air compressors.

NAME
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CIRCLE 79 ON TIME-SAVER CARD

CIRCLE 93 ON TIME-SAVER CARD

write for NEW FREE CATALOG

of Kendall—
Governaire
precision pneumatic

PRESSURE REGULATORS for Industry

The facts you need on a complete range of pneumatic pressure regulating valves and volume boosters. Here is your guide to a series of pilot-operated and direct acting regulators—in pipe sizes from ¼ to ⅜ and ¾ NPT...in supply pressures up to 250 psi. Fact-filled pages spell out the full story: characteristics • pressure ranges, ratios • applications—for 16 different models including motor operated and lever set types.

Write today for the new KENDALL- GOVERNAIRE catalog.

STRATOS
INDUSTRIAL PRODUCTS BRANCH
Route 109, West Babylon, N. Y.
A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Turbo-Expanders and Compressors
SPECON Variable Speed Drives and Transmissions
Pneumatic Pressure Regulators

POST SCRIPTS OF INDUSTRY

Arthur Schiefelbein was promoted to general sales manager of **Mechanical Air Controls, Inc.** For the past 3½ years he has been the company's regional representative in the Detroit area.

A. Schiefelbein
Mechanical Air Controls

Van R. French
Jamesbury Corp.

Van R. French was named production manager of the **Jamesbury Corp.**, Worcester, Mass. The company has just doubled its manufacturing space by making an addition to its relatively new plant, into which Jamesbury moved early in 1957.

Stop Excessive Bearing Wear with Light-Weight Couplings

All flexible couplings operate in an unbalanced condition when coupling misaligned shafts. And when turning at 1750 rpm, each inch-ounce of unbalance produces a vibration-creating force of about 5½ lbs. Magnaloy couplings are made of a magnesium alloy weighing 80% less than steel, the common coupling material. Less weight means less vibration and less wear on equipment bearings. Write for the Magnaloy Catalog today.

DETROIT POWER COUPLING CO.
992 West Seven Mile Road • Detroit 3, Michigan

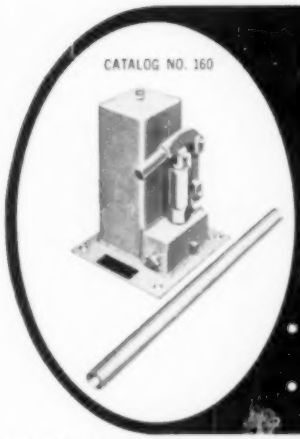
Series B

Series A

Attention Representatives

MAGNALOY
FLEXIBLE DRIVE COUPLINGS
PATENTS PENDING

CIRCLE 29 ON TIME-SAVER CARD



Hand Hydraulic Pumps

- Single and Double Designs to 20,000 psi
- With or Without Reservoir

160 cubic inch reservoir with 8"x 8" base plate and 18" long handle.

Available with optional size pistons ⅜", ½", ¾", 1" and 1½".

We specialize in the manufacture of hand pump units which operate in temperatures from −65° F. to +160° F. and with any capacity reservoirs required. Pumps can be furnished on special order with custom seals to handle various aircraft types of fuels such as Pydraul, Skydrol, Oronite, etc.

The single pump with ½", ¾", 1" or 1½" piston is now available in stainless steel.

for additional information write:

WILLIAM S. PINE
hydraulic hand pumps for 1001 uses
1635 East 22nd St., Los Angeles 11, Calif.

CIRCLE 75 ON TIME-SAVER CARD

Parker Seal Company, division of Parker-Hannifin Corp., Cleveland, Ohio and Culver City, California, appointed R.R. Brauchler as field representative in the Southeast.

Parker-Hannifin Corp., Cleveland, Ohio, named these new distributors: **F. D. Johnson Co.,** Solon, Ohio, for reusable Hoze-lok fittings and hose assemblies. **T. D. Sandelius Co.,** Houston, Texas, with branch offices at Baton Rouge, Louisiana, for tube and hose fittings and associated items. **Globe Machinery and Supply Co.,** Des Moines, Iowa, for Hoz-lok fittings and industrial hose.

Immediate service in the New York metropolitan area will be provided by a new New York district office of **Fuller Co., a subsidiary of General American Transportation Corp.** Located at 330 Madison Ave., this new office will be managed by **Andrew van der Lyn.**

Vickers, Inc., Division of Sperry Rand Corp., Detroit, Michigan, has announced these staff changes: **Robert P. Dodds** was appointed sales engineer in the

Robert P. Dodds
Vickers, Inc.

L. J. O'Donoghue
Vickers, Inc.

Aero Hydraulics Div., with headquarters in the Albertson, Long Island office. **Leslie J. O'Donoghue** promoted to district manager, Automotive Products, headquartered in Detroit. **Charles D. Scribner** was named to fill the newly created post of vice president of personnel.

The Burhans-Sharpe Co., South Seattle, Washington has become sales representative for the **R. P. Adams Company,** Buffalo, N. Y. **C. W. Burhans, Jr.,** and **Philip Sharpe** will cover the state of Washington and the northwest counties of Idaho from the Seattle office. Oregon will be covered by **Robert Bruning** from their Portland, Oregon, office.

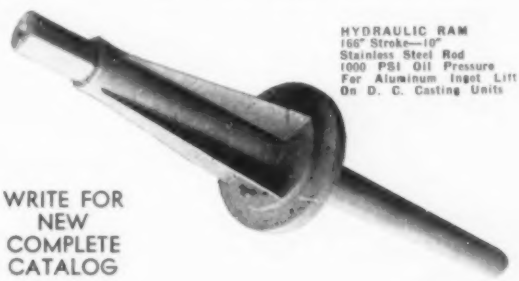
Clare Engle was appointed superintendent of manufacturing and **George Diggles** manager of production engineering of the **Hydreco Division, New York Air Brake Co.,** Kalamazoo, Michigan.

L. A. Christopher Co., Denver, Colorado, was named representative for **Wm. W. Nugent & Co., Inc.,** for the states of New Mexico, Colorado, Wyoming and Montana.

Republic Manufacturing Co., Cleveland, Ohio, appointed two new stocking distributors. **Rockford Tool & Transmission Co.,** Rockford, Ill.; and **Nix Industrial Supply Co.,** Tulsa, Oklahoma.

Lincoln AIR AND HYDRAULIC Cylinders

The answer to the increased demand for rugged, heavy duty air and hydraulic cylinders. Designed for the hardest usage in Steel Mill operation or for the hundreds of other modern cylinder applications that require dependable efficient service.



WRITE FOR NEW COMPLETE CATALOG

Lincoln MACHINE CO. INC.

P. O. Box 272 EDgewood 2-4689 Salem, Ohio

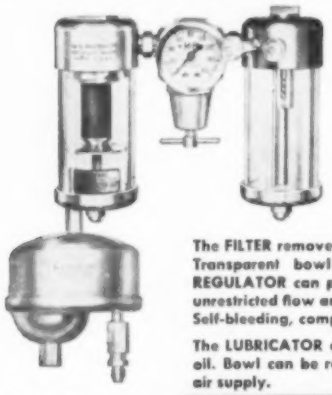
CIRCLE 58 ON TIME-SAVER CARD

CIRCLE 32 ON TIME-SAVER CARD

GREATER PROTECTION to your AIR LINE!

M·B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

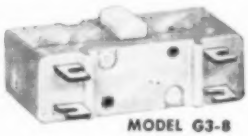
The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M·B PRODUCTS
46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

Tiny 40 amp. basic switch has high capacity, longer life and constant stability of tolerances

Measuring only 1¾" x 43/64" x 35/64", the Electro-Snap G3-8 Basic Switch handles current ratings up to 40 amps. A new method of combining Electro-Snap's double-break action with a heavy-duty switching element assures electrical and mechanical life of 100,000 cycles at large capacities; also provides constant stability of tolerances and accurate repeatability. New plastic compound case gives the switch an ambient temperature rating of —100° to +300° F. with extreme shock resistance. Small size makes it ideal for motor controls and compact automation set-ups. A wide range of actuators is available.



MODEL G3-8

OPERATING CHARACTERISTICS

Single Pole, Double Throw
40 AMPS @ 125/250 V. A.C.
@ 30 V. D.C. Res.

Oper. Force, 45 oz. Approx.
Overtravel, .015" Min.
Move. Differ., .055 ± .010

WRITE FOR DETAILS IN DATA SHEET F-12

ELECTRO SNAP

ELECTROSNAP CORPORATION
4224 W. LAKE ST., CHICAGO 24, ILLINOIS
Telephone VAn Buren 6-2100
Twx No. CG-1400

CIRCLE 61 ON TIME-SAVER CARD

CIRCLE 105 ON TIME-SAVER CARD

new 6"x3"

WAGNER HYDRAULIC BRAKE SYSTEM

Provides sure stops for smaller cranes

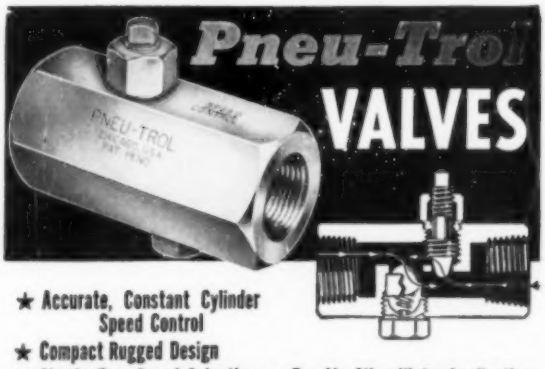
Wagner now offers a new 6" x 3" size hydraulic brake to provide the correct braking system for floor operated pendant controlled cranes, monorail cranes or small cab operated cranes. These hydraulic brakes will stop your cranes safely . . . easily . . . economically.

Let your nearby Wagner Sales Engineer help you put the *right* braking system on your small or large cranes—let him help you with tension control or hydraulic actuating problems—call him today, or write for Wagner Bulletin IU-226.

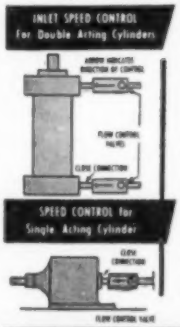
W158-3

Wagner Electric Corporation
6387 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

Pneu-Trol VALVES



★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications



Pneu-Trol Speed Control Valves are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.
2919 GRANT STREET • BELLWOOD (Chicago Suburb) ILLINOIS

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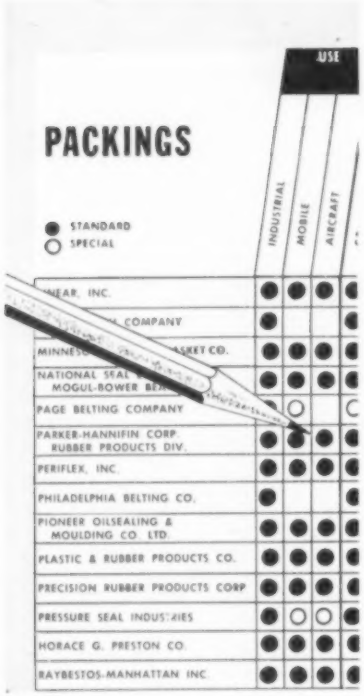

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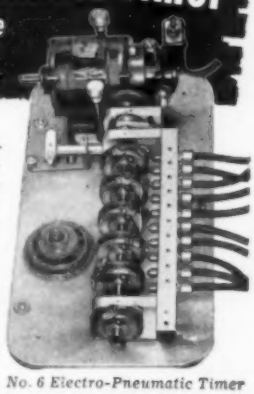

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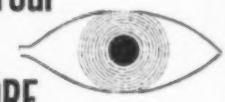

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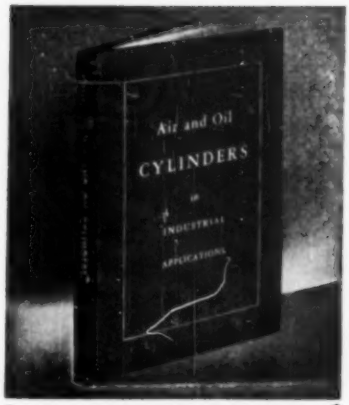

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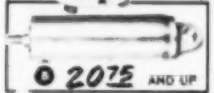

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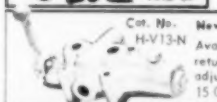

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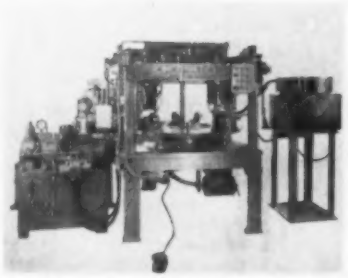

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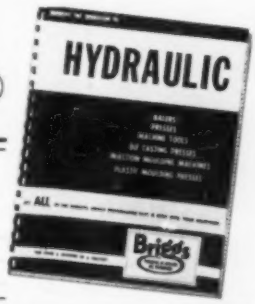

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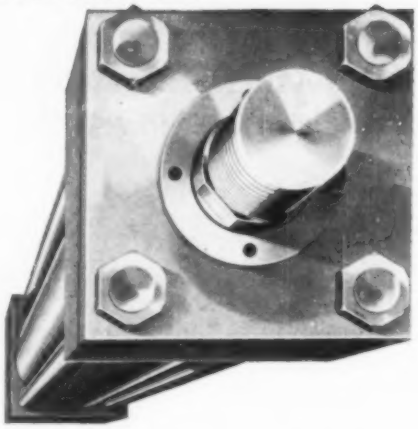

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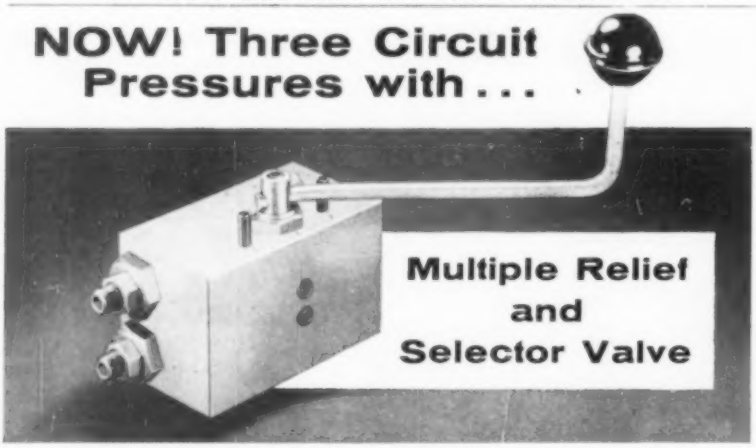

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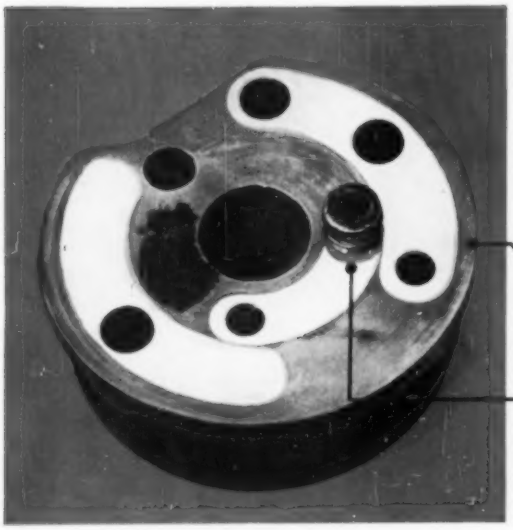

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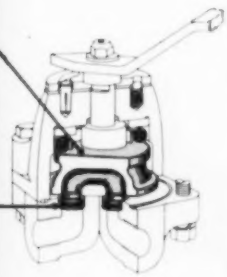

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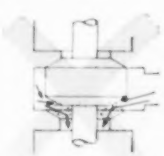

3000 P.S.I. Shut-Off

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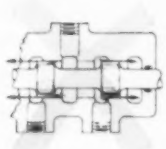

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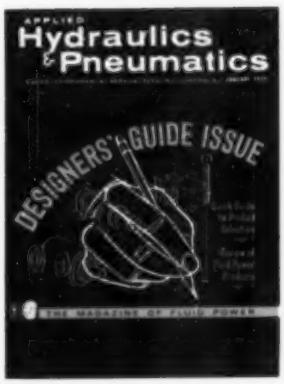

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